VOL. 23, No. 3 MARCH, 1946

THE LIBRARY OF CONGRESS SERIAL RECORD
MAR 6 1946
Copy

AMERICAN JOURNAL OF OPTOMETRY and ARCHIVES of AMERICAN ACADEMY OF OPTOMETRY

EDITORIAL COUNCIL

J. FRED ANDREAE, *Baltimore, Md.*
R. E. BANNON, *Hanover, N. H.*
H. M. FISHER, *New York, N. Y.*
GLENN A. FRY, *Columbus, Ohio*
R. M. HALL, *Cleveland, Ohio*
E. E. HOTALING, *New York, N. Y.*
D. G. HUMMEL, *Cleveland, Ohio*
J. F. NEUMUELLER, *Philadelphia, Pa.*
D. R. PAINE, *Topeka, Kan.*
E. PETRY, *Rochester, N. Y.*
E. LEROY RYER, *New York, N. Y.*
A. P. WHEELOCK, *Des Moines, Iowa*

EDITORS

CAREL C. KOCH, *Minneapolis, Minn.*

RUDOLPH H. EHRENBERG, *Granite Falls, Minn.*
CLARENCE W. MORRIS, *Fort Wayne, Ind.*

COLLABORATORS

A. N. ABBOTT, *Shawano, Wis.*
EARL ALLGAIER, *Washington, D. C.*
M. B. ALPERN, *Chicago, Ill.*
J. E. ASARKOFF, *Boston, Mass.*
F. L. AVERA, *Los Angeles, Calif.*
JAMES O. BAXTER, JR., *New Bern, N. C.*
R. C. BAXTER, *Warren, Ohio*
E. A. BETTS, *State College, Pa.*
M. J. BLAESS, *Detroit, Mich.*
SOLON M. BRAFF, *Los Angeles, Calif.*
H. F. BRANDT, *Des Moines, Iowa*
F. W. BROCK, *Staten Island, N. Y.*
J. J. BROWN, *Perth Amboy, N. J.*
BRANT CLARK, *San Jose, Calif.*
PAUL S. CLINE, *Boston, Mass.*
T. COHEN, *New York, N. Y.*
R. F. COOPS, *San Diego, Calif.*
W. E. DEWEY, *Battle Creek, Mich.*
G. L. DUPLESSIS, *Minneapolis, Minn.*
ISRAEL DVORINE, *Baltimore, Md.*
T. H. EAMES, *Arlington Center, Mass.*
M. T. EBERL, *Milwaukee, Wis.*
V. ELLERBROCK, *Columbus, Ohio*
T. A. W. ELMGREN, *Columbia, S. C.*
A. B. EMMES, *International Falls, Minn.*
H. WARD EWALT, *Pittsburgh, Pa.*
W. S. FARMER, *Oklahoma City, Okla.*
R. FEINBERG, *New York, N. Y.*
WM. FEINBLOOM, *New York, N. Y.*
L. P. FOLSOM, *South Royalton, Vt.*
E. FREEMAN, *Chicago, Ill.*
H. K. FULKERSON, *Somerset, Ky.*
H. L. FUOG, *Los Angeles, Calif.*
W. H. GLAZER, *Philadelphia, Pa.*
J. G. GOODSELL, *Los Angeles, Calif.*
P. B. GOSS, *Philadelphia, Pa.*
R. GRAHAM, *San Francisco, Calif.*
W. GREENSPON, *Bluefield, W. Va.*
R. GREENSPOON, *Beverly Hills, Calif.*
HOWARD F. HAINES, *Columbus, Ohio*
W. J. HEATHER, *Southbridge, Mass.*
J. H. L. HEBERT, *Montreal, Quebec*
M. J. HIRSCH, *Berkeley, Calif.*
H. W. HOFSTETTER, *Columbus, Ohio*
E. A. HUTCHINSON, *Los Angeles, Calif.*
O. H. JOHNSON, *Jonesboro, Ark.*
J. C. KEHOE, *Flint, Mich.*
WM. M. KETCHUM, *Los Angeles, Calif.*
L. H. KRASKIN, *Washington, D. C.*
A. R. LAUER, *Ames, Iowa*
M. LUCKIESH, *Cleveland, Ohio*
G. A. MACELREE, *Philadelphia, Pa.*
A. H. MALIN, *Philadelphia, Pa.*
E. J. MARGARETTEN, *New York, N. Y.*
H. B. MARTON, *Manchester, Eng.*
JOHN W. MOGEY, *New York, N. Y.*
M. W. MORGAN, *Berkeley, Calif.*
JOHN C. NEILL, *Philadelphia, Pa.*
G. O. OHLSSON, *Detroit, Mich.*
G. A. PARKINS, *Ord, Nebr.*
H. B. PETERS, *Chico, Calif.*
HARRY E. PINE, *Chicago, Ill.*
E. E. REESE, *Westerville, Ohio*
E. H. RIDGEWAY, *Trenton, N. J.*
CHARLES I. SAKS, *Syracuse, N. Y.*
P. SCHOLLER, *Hancock, Mich.*
N. SCHULER, *British Guiana, S. A.*
CHARLES SHEARD, *Rochester, Minn.*
S. H. SHURIN, *Kansas City, Mo.*
R. E. SIMPSON, *Pasadena, Calif.*
S. W. SMITH, *Philadelphia, Pa.*
WM. SMITH, *Roxbury, Mass.*
K. B. STODDARD, *Berkeley, Calif.*
MILES A. TINKER, *Minneapolis, Minn.*
W. TRILLER, *Hanover, N. H.*
R. N. WALKER, *Winston-Salem, N. C.*
RITA WALSH, *Hanover, N. H.*
ARENE T. WRAY, *Los Angeles, Calif.*
N. A. ZEVIN, *Lehighton, Pa.*

Published Monthly by the AMERICAN JOURNAL OF OPTOMETRY PUBLISHING ASSOCIATION, 1502 Foshay Tower, 821 Marquette Ave., Minneapolis 2, Minn.

ANNUAL SUBSCRIPTION $5.00 CANADA $5.50, FOREIGN $6.00
Single copies, 50c

Entered as second-class matter, February 20, 1924, at the post office at Minneapolis 2, Minnesota, under the Act of March 3, 1879.
Established 1924

Eyes Well Cared for
Eyes Well Dressed

A Cushion-Lock Numont Rimless Ful-Vue Forms the Setting for Kurova Wide Angle Lenses.

. . . The Lenses are Cushioned Against Breakage

ARMY E NAVY

Continental INDIANAPOLIS

AMERICAN ACADEMY OF OPTOMETRY

Dr. J. Fred Andreae, *President*
Baltimore, Md.

Dr. Harold M. Fisher, *Vice-President*
New York, N. Y.

Dr. Carel C. Koch, *Secretary*
Minneapolis, Minn.

EXECUTIVE COUNCIL

Dr. J. Fred Andreae, *Chairman*
Baltimore, Md.

Dr. Harold M. Fisher, *Vice-Chairman*
New York, N. Y.

Dr. Carel C. Koch, *Secretary*
Minneapolis, Minn.

Dr. Arthur P. Wheelock, *Past President*
Des Moines, Iowa

Dr. Robert E. Bannon
Hanover, N. H.

Dr. W. Edward Dewey
Battle Creek, Mich.

Dr. D. G. Hummel
Cleveland, Ohio

Dr. E. A. Hutchinson
Los Angeles, Calif.

Office: American Academy of Optometry: 1502 Foshay Tower, Minneapolis 2, Minn.

The AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY serves as the official publication of the American Academy of Optometry. It is published monthly by the American Journal of Optometry Publishing Association under the editorial supervision of the American Academy of Optometry.

Publication Office: 1502 Foshay Tower, 821 Marquette Ave., Minneapolis 2, Minn.

AMERICAN JOURNAL OF OPTOMETRY *and* ARCHIVES *of* AMERICAN ACADEMY OF OPTOMETRY

VOL. 23 — No. 3

CONTENTS

ORIGINAL PAPERS

A New Theory for the Control of Accommodation. Meredith W. Morgan . . . 99

Changes in Power and Axis of Cylindrical Errors After Convergence. William Beau-Seigneur . . . 111

EDITORIALS . . . 122

TRANSACTIONS OF THE ACADEMY . . . 125

ANNOUNCEMENTS . . . 129

SPECIAL REPORTS . . . 134

ABSTRACTS . . . 139-144

Another
Orthogon
Advantage

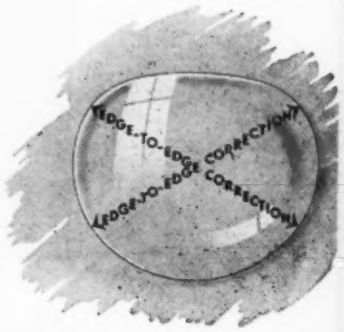
Large Lens Blanks for *Modern* Lens Shapes

Orthogon lenses are in tune with modern style demands—they are easily cut to any of the large lens shapes so popular today. Available in single-vision spheres and sphero-cylinders, in all commonly used powers. Supplied 51½ mm high and wide (54½ mm on the diagonal), both semi-finished and uncut. Another reason for the great popularity of Orthogon—the famous corrected-curve lenses. Bausch & Lomb Optical Co., Rochester 2, N. Y.

In Soft-Lite, too.

BAUSCH & LOMB

ESTABLISHED 1853



. . . and that means ARTCRAFT! For ARTCRAFT eyewear has simplicity of line . . . impeccable good taste . . . the unmistakable air of quality that functional design, properly applied, always imparts . . . adding up to *smartness* in any patient's language. Even more important, ARTCRAFT styling also insures perfect lens alignment thus pleasing both patient and practitioner.

ART-CRAFT OPTICAL COMPANY • ROCHESTER 6, N. Y.

FRANK CALLAHAN SAYS:
BAY STATE'S IMPROVED ZYL FINISH BEATS ANY WE'VE EVER HAD . . .
Frank Callahan started with Bay State in 1894, and although now sixty-six years old and foreman of the Finishing Department, can hold his own with the younger men. He was born in Attleboro, is married and has three children — one a pharmacist's mate aboard the battleship "Washington."
HAL FRATER

And he should know! Frank's proud of the work he's been doing at Bay State for fifty-two years—more than twenty-five of those years polishing zyl rims and frames to a lasting lustre that makes for Bay State superiority. He can't stop talking about this new finish—the absence of polishing marks, the depth of lustre, and the way it leaves the finished frame sparkling and jewel-like in appearance—Bay State's notably fine zyl finish made even better!

Developing this superb finish climaxed a long period of research and experiment at Bay State. This technical skill, combined with the craftsmanship of men like Frank Callahan, is the Bay State heritage and tradition . . . the tradition that has made BSO the symbol for quality ophthalmic materials for so many years.

Traditional Craftsmanship Since 1862

ATTLEBORO, MASSACHUSETTS

CHICAGO: 28 East Madison Street
CANADA: Imperial Optical Co.; National Optical Co.

BSO
BAY STATE OPTICAL COMPANY

"BETTER THINGS FOR BETTER VISION IN 1946"

Confidence

A good name in which the Profession has faith comes only after years of conscientious service and respect for professional prestige. **TITMUS** has been rendering that type of service for more than 38 years. When you specify **TITMUS PERFEX** on your prescriptions, for single vision lenses and also bifocals, you do so with the confidence you are providing your patients with ophthalmic lenses of the highest degree of perfection and effectiveness.

Titmus Lenses Are Available from Leading Independent Rx Houses from Coast to Coast!

TITMUS OPTICAL CO., INC., PETERSBURG, VA., U. S. A.

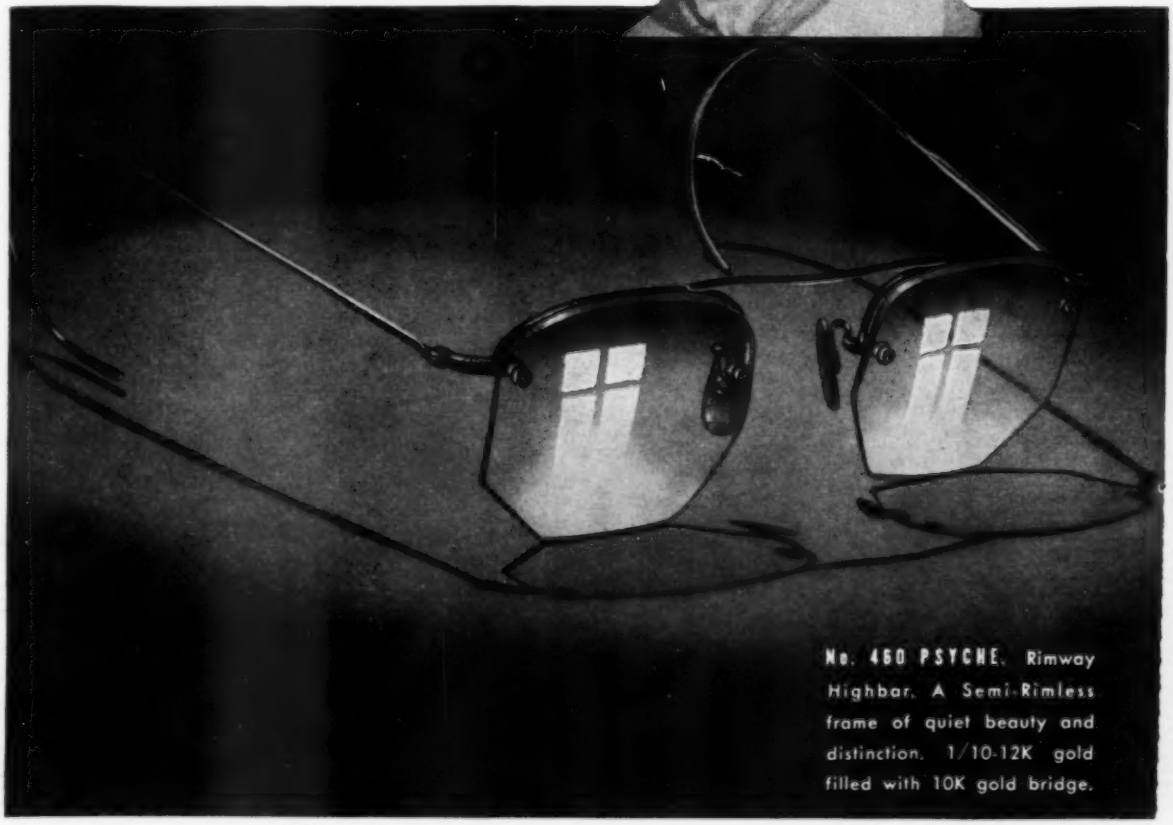
WHAT ARE YOU LOOKING FOR IN FRAMES?

if it's beauty look to *Century*

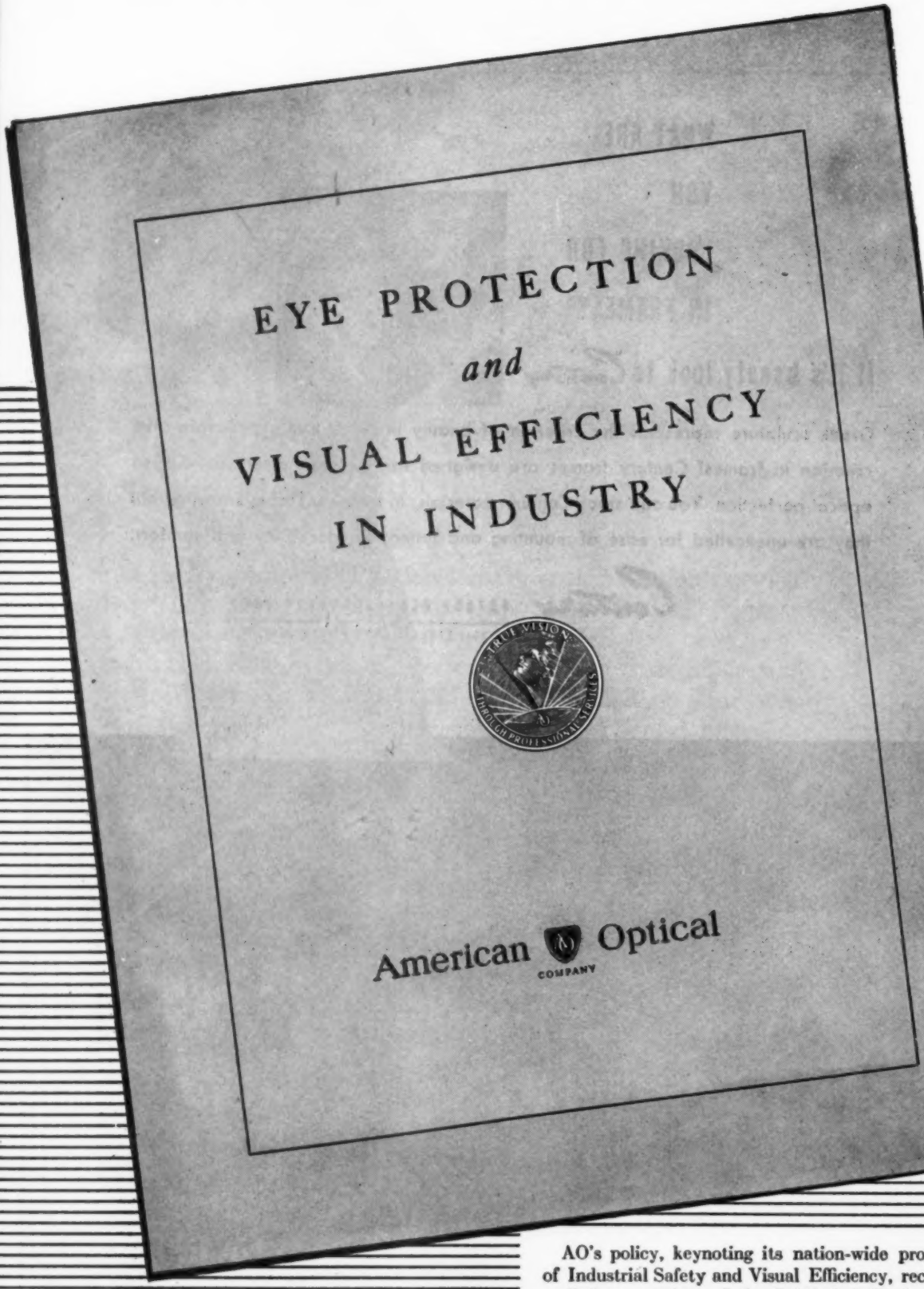
Greek sculpture represents the criterion of beauty in art... Century Oxford—the criterion in frames! Century frames are designed for feature flattery as well as optical perfection. You can stock Century materials, in metal or Lurite, knowing that they are unexcelled for ease of mounting and fitting, for durability and comfort.

Century OXFORD MANUFACTURING CORP.

5112-21st STREET • LONG ISLAND CITY, N.Y.



No. 460 PSYCHE. Rimway Highbar. A Semi-Rimless frame of quiet beauty and distinction. 1/10-12K gold filled with 10K gold bridge.



AO's policy, keynoting its nation-wide program of Industrial Safety and Visual Efficiency, recently mailed to members of the Ophthalmic Professions.

INDUSTRIAL SAFETY & VISUAL EFFICIENCY

On January 1, 1946, American Optical published a printed policy establishing the basis on which the company supplies protective goggles, corrective-protective materials and screening devices for industrial application.

This printed policy is part of a program developed by American Optical to facilitate cooperative relations between the Ophthalmic Professions and Industry. Copies of this statement incorporating the company's policy have been mailed to Ophthalmologists, Optometrists, and Ophthalmic Dispensers.

In brief, the AO Program for Industrial Safety and Visual Efficiency:

Establishes the concept that the true benefits in industrial eye care are derived from the application of professional and technical eye care services.

Offers a workable plan by which the Professions and Industry can provide a greater measure of visual efficiency and safety to industrial employees.

Presents helpful literature and personal counsel to the Professions as they assume their responsibilities in the interest of better industrial vision.

This policy statement deserves the attention of every interested professional man.

American Optical
COMPANY

SUCH *Outstanding Dependability...*

is the reason many thousands of careful refractionists specify Riggs Rx Service in filling their prescription needs.

Riggs is proud of this expression of confidence in its Rx Service and constantly strives to remain worthy of it in every prescription.

When you prescribe via Riggs Rx Service you may be sure of high quality, superior service and dependability.

Riggs Optical Company

Distributors of Bausch & Lomb Ophthalmic Products

General Offices, Chicago, San Francisco

BRANCHES IN PRINCIPAL WESTERN AND MID-WESTERN CITIES

AMERICAN JOURNAL OF OPTOMETRY
and ARCHIVES *of*
AMERICAN ACADEMY OF OPTOMETRY

Vol. 23 MARCH, 1946 No. 3

A NEW THEORY FOR THE CONTROL OF ACCOMMODATION*‡

Meredith W. Morgan, Jr.†
Berkeley, California

The method whereby the refractive power of the eye is changed, so that near as well as distant objects may be imaged upon the retina, has been subject to investigation and speculation since the rise of the experimental method at the beginning of the 17th century. The results of these investigations and speculations has led to the proposal of numerous theories of accommodation, the mere outlining of which would make this paper unnecessarily long. To aid the curious, the bibliography appended to the end lists the more important publications reporting on these theories.

The many hypotheses advanced which proposed that either changes in axial length, corneal curvature, or position of the crystalline lens is responsible for accommodation, were all disproved by Thomas Young[1] as early as 1801. Despite this, however, these theories are not entirely dead as witness the many followers of Bates[2] who taught that accommodation results from increased axial length. All modern authorities are agreed that the alteration in dioptric power of the eye is brought about by changes in the curvatures of the crystalline lens and all theories of importance since the time of Young have been advanced to explain how these changes in curvature are brought about. The three most popular theories are the "hydraulic theory", the "theory of increased tension", and the "theory of decreased tension."

The hydraulic theory has perhaps been most succinctly stated by

---

* Read before the Twenty-second Annual Meeting of the American Academy of Optometry, on December 12, 1945, at Columbus, Ohio. For publication in the March 1946 issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

† Optometrist. Assistant Professor, School of Optometry, University of California. Fellow of American Academy of Optometry.

‡ Aided by a grant from the American Academy of Optometry.

Hill[3]. "Accommodation is established by a perfectly balanced transference of fluid from the front to the circumferential region of the lens; this transference, brought about by the ciliary muscle, causes the lens to become more convex."

The theory of increased tension claims that when a distant object is in focus upon the retina the ciliary muscle is relaxed and that the crystalline lens is free from stress. When the eye is focused upon a near object, the ciliary muscle contracts exerting a pressure upon the vitrious and lens causing the lens to be put under tension which forces the anterior face of the lens to bulge. This idea was proposed by Mannhardt[4] as early as 1858. The strongest advocate of this theory was Tscherning[5] who observed that the anterior face of the lens becomes hyperbolic in shape during active accommodation. He felt that this alone disproved Helmholtz's theory, next to be described, and because he so actively upheld this "theory of increased tension" it is most commonly called "Tscherning's Theory of Accommodation."

The theory of decreased tension really owes its origin to Young[6] but its most forceful champion was Helmholtz[7] and consequently this theory is better known as "Helmholtz's Theory of Accommodation." This theory is modified by Gullstrand[8] and Fincham[9] states the capsule of the lens as an elastic body under constant tension of the suspensory ligaments when the eye is focused upon a distant object. Then when the eye accommodates for a near object, the ciliary muscle contracts neutralizing the pull of the suspensory ligaments upon the elastic capsule which now molds the plastic lens into a more spherical form.

This theory of decreased tension is the one most universally accepted. The evidence in favor of it constitutes almost direct proof that in positive accommodation; that is, accommodation for near objects, the tension on the suspensory ligaments and lens capsule is released while in negative accommodation the tension is increased. The question now arises as to how this change in tension is brought about. It is generally taught that positive accommodation is brought about by active contraction of the ciliary muscle innervated by the oculomotor nerve which moves the ciliary body forward and toward the axis of the eye thus releasing tension from the suspensory ligaments and that in negative accommodation the reverse process occurs; namely, decrease in nerve flow and relaxation of the ciliary muscle.

Henderson[10] has pointed out that the Helmholtz theory implies that the choroid sustain the elastic traction of the lens and must actively take part in negative accommodation. He thought that the choroid,

being a vascular organ, was ill prepared to sustain this tension. He, therefore, postulated that the radial and longitudinal elements of the ciliary muscle under the control of the sympathetic nervous system actively caused negative accommodation. This idea was not original with Henderson, it being the main contention of Morat and Doyon[11] as early as 1891. The stimulus that started our investigation of accommodation was furnished by Cogan[12] who marshalled in 1937 the then existing evidence into an article in which he came to the conclusion that negative accommodation was an active as well as a passive occurrence.

Since the Fall of 1939 we have been investigating all the possibilities of the nervous control of accommodation. Our detailed report of results may be found in various publications.[13] Briefly, we have found that stimulation of the sympathetic nervous system in man, dog, monkey, cat and rabbit causes a decrease in the total refractive power of the eye while stimulation of the parasympathetic causes an increase in the refractive power. The results of stimulation are not equal as stimulation of the parasympathetic in the cat, for example, gives rise to dioptric changes approximately 10 times that of stimulation of the sympathetic. We have also demonstrated that stimulation of either nervous system without the compensating effects of the other leads to the appearance of astigmatism. It would thus appear that the case for the reciprocal innervation of the ciliary muscles as postulated by Henderson was definitely proven. However, there are certain difficult facts that must be accounted for.

The greatest difficulty is in the difference in the anatomy of the ciliary body of the various mammals used. Wall[14] has pointed out that, "Circular ciliary muscle fibers, forming a 'muscle of Müller' with an especially efficient orientation, are known to occur only in seals, primates (best in man) and in some toothed whales and some ungalates", Almost as distressing to any theory such as that proposed by Henderson is the fact that no histologist has ever found sympathetic nerve endings in any of the muscle groups of the ciliary body. All sympathetic nerves in the ciliary muscle seem to end upon blood vessels. Thus there is a double dilemma as far as Henderson's theory is concerned: first, there is no possibility for reciprocal action in the normal sense because there are not opposing muscle groups in every case and, second, even if there were opposing muscle groups as in the primates, there is no nervous system to carry out reciprocal action.

This exact same dilemma faces physiologists with regard to pupillary activity. The first theories considered that only the oculomotor

nerve and sphincter muscle were involved in pupillary constriction and pupillary dilation. However, since the classical experiments of Langley and Anderson[15] it has been thought, until recently, that pupillary activity was reciprocally controlled by both the sympathetic nervous system and the parasympathetic. Of recent years there has been considerable doubt as to this. With very few exceptions, most researchers come to the conclusion that the sympathetic plays no role in normal reflex pupillary changes. Langworthy[16] claims, "Two antagonistic muscles balanced against each other, innervated by two separate groups of autonomic nerve fibers are not required to explain pupillary movements . . . If there is any dilator muscle present in the iris, it has little, if any role in the normal phasic activity producing changes in the size of the pupil."

The difficulty is, of course, stimulation of the sympathetic does cause pupillary dilation. Langworthy [17] has presented a rather ingenious theory to account for the known facts of pupillary activity. He based his theory not only on his own anatomical researches but upon the work of Gellhorn[18] who showed pupil size to follow exactly variations in blood pressure. According to Langworthy the sphinctar muscle acts against a tonal background maintained by the blood volume of the iris and the natural elasticity of the blood vessels. Thus when the sympathetic is stimulated, the arterioles and capillaries constrict forcing the blood out of these vessels. This reduces the mass of the iris and causes the pupil to dilate. Ordinary reflex activity is mediated solely by the oculomotor nerve but the tonal background is sympathetically controlled.

It is my contention that the same type of theory may be adapted for the action of the ciliary body. We cannot dismiss the idea of sympathetic control of negative accommodation on the basis that there are no muscle fibers to carry out this action because the fact will still remain, stimulation of the sympathetic does lead to a decrease in the refractive power of the eye.

We have attempted to control the state of refraction by raising and lowering the blood pressure just as Gellhorn[19] did with respect to pupil diameter. In some respects the results are clouded by the necessity of using chemical mediators such as epinephrine and amyl nitrite. The injection of epinephrine always results in the following reactions: 1. increase in general blood pressure in the cat, of from 10 to 40 mm of Hg., 2. dilation of the pupil, 3. increased hypermetropia. On the other hand the results with amyl nitrite which cause dilation of the peripheral vessels does not lead to uniform results. Our experiments are being continued in order to find the exact cause of this variation in response. Breathing

amyl nitrite gives these variable results: 1. very slight to marked fall in systemic blood pressure, 2. very slight dilation to marked constriction of the pupil, and 3. very slight increase in refractive power (myopia) to no change.

At the present time an investigation is under way in the Division of Physiology of the University of California to determine the cause of myopia in subjects suffering from diabetis. One of the factors under consideration is any possible change either in lens position or in the index of refraction of the vitreous. In order to cause rapid changes small amounts (0.05 cc to 0.20 cc) of hypertonic or hypotonic solutions were injected into the vitreous chamber of cats and the change in refractive error noted. In all cases regardless of the tonicity of the solution there was a decrease in the refractive power of the eye (increase in hypermetropia) and in most cases there was astigmatism of the inverse type. Now if this injected fluid caused an over all increase in pressure which would move the lens forward there should be an increase in the refractive power. On the other hand, if the change was due to the physical chemical reaction of the injected fluid there should be a change in the reaction depending on the tonicity of the fluid used. If there is any difference on injection, it is a slight difference depending on the amount of fluid injected. Thus the change must be due to a pressure phenomenon which either does not move the lens of the eye forward, or if it does move the lens forward, it must at the same time flatten the lens more than enough to compensate for this forward movement.

This decrease in the refractive power may be prevented from occuring or entirely overcome, by the use of amyl nitrite depending on whether it is used before or after the injection into the vitreous chamber.

Typical data are shown below:

2.3 kilo cat, nembutal

Normal refraction (atropine cycloplegia): + 2.50 D. S.
Injection 0.15 cc normal Ringer's solution: + 5.00 ⌒ —1.00 ax 90
Amyl nitrite : + 3.00 ⌒ —1.00 ax 90

The changes occur in the refractive state independently of the use of atropine or any other cycloplegia.

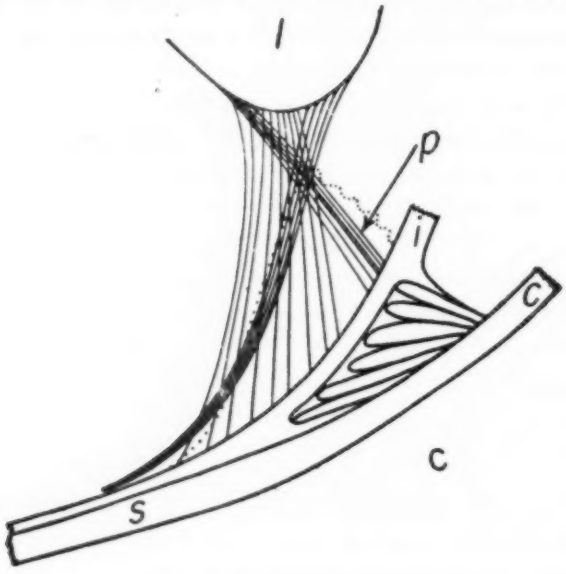
From the evidence the following conclusions seem to be warranted:

1. Stimulation of the sympathetic causes a decrease in the total refractive power of the eye,
2. This decrease is not due to muscular action,
3. Pressure upon the ciliary processes from within outward causes a

decrease in refractive power comparable to that obtained by stimulation of the sympathetic, and

4. Dilation of the arterioles and capillaries of the eye counteract this pressure response.

There is one supposition that need be made to explain these observed phenomena: The tension on the suspensory ligaments increases and decreases depending on the mass and hence the blood volume of the ciliary body. Reference to figure one will make this clear. If the mass of the ciliary body is made less by a decrease in blood volume due to constriction of the vessels within the ciliary body, that section of the ciliary body shown as giving rise to the iris will move toward the sclera increasing the pull on the suspensory ligaments and hence flattening the lens. On the other hand if the mass of the ciliary body is increased by increased blood volume due to dilation of the blood vessels, the area giving rise to the iris will move toward the axis of the eye decreasing the pull on the suspensory ligaments and hence allowing the lens to become more convex. Thus we may suppose that reflex activity, normal positive and negative accommodation are under control of the muscles of the ciliary body activated by increased or decreased nerve impulses over the oculomotor nerve. This activity, however, is superimposed upon a tonal background influenced by impulses over the sympathetic.



As optometrists, we are all familiar with the sometimes rather sudden increase in hypermetropia after the age 45-50. This has frequently been interpreted as a natural decrease in the tone of the ciliary muscle or a change in the curvature of the lens or change in index. However, it seems just as logical to assume that this increase may be due to a decrease in the mass of the ciliary body from a natural decrease in blood volume due to sclerosis of the blood vessels.

Henderson[20] has postulated that presbyopia is due to the sclerosis of the connective tissue of the ciliary body. He did this because as Duane[21] has pointed out the Helmholtz theory has great difficulty in explaining presbyopia as being due to nuclear sclerosis while the lens cortex remains soft. However, if in addition to the sclerosis of the nucleus of the lens and the connective tissue of the ciliary body we consider a decrease in mass of the ciliary body and loss of vessel elasticity due to sclerosis, the cause of presbyopia seems to be adequately accounted for.

We have also observed as optometrists, the tendency for the number of patients with the inverse type of astigmatism to increase with the age level of patients. May this not be due also to the uneven pull upon the suspensory ligaments by the decreasing mass of the ciliary body? The reason for the difference in pull being due to the corresponding difference in size and shape of the ciliary body.

One of the symptoms of glaucoma is a sudden decrease in the amplitude of accommodation. This may be due to an increase in pressure upon the ciliary body tending to decrease its mass and hence increasing the pull on the suspensory ligaments such that the natural contraction of the ciliary muscle would not overcome the pressure effect.

This theory of a tonal background due to vascular changes, under control of the sympathetic, for accommodation has been presented to you in the hope that it may stimulate your thinking. The research work has not been completed on this project as yet. When further information has been obtained, it will be reported.

REFERENCES

[1]Young, Thomas, On the Mechanism of the Eye, Phil. Trans., 19:23, 1801.
[2]Bates, W. A., The Cure of Imperfect Sight by Treatment without Glasses, 1920.
[3]Hill, Blood Vessels and Pressure, Lancet, 198:359, 1920.
[4]Mannhardt, Bemerkogen über den Accommodationsmuskel und die Accommodation, Arch. fur Ophk., 4:269, 1858.
[5]Tscherning, M., The Mechanism of Accommodation, Ophth. Rev., 23:95, 1904.
[6]Young, ibid.
[7]Helmholtz, H., Ueber die Accommodation des Auges, Arch. fur Ophth., 1:1, 1855.
[8]Gullstrand, Einfuhrung, indes Methodes de Droptrik des Auges, 1911 quoted from Duke-Elder, Text book of Ophthalmology, Vol. I.

[9]Fincham, E., The Mechanism of Accommodation, Brit. J. Ophth., Monograph Supp. VIII, 1937.

[10]Henderson, T., The Mechanism of Accommodation and the Comparative Anatomy of the Ciliary Region, Ophthalmoscope, 10:502, 1912.

[11]Morat & Doyon, Le Grand Sympathique, Nerf de l'Accommodation pour la Vision des Objets Éloignés, Ann. d'Ocul., 106:28, 1891.

[12]Cogan, D. N., Accommodation and The Autonomic Nervous System, Arch. Ophth., 18:739, 1937.

[13] a. Mohney, J., Morgan, W. W., Jr., Olmsted, J. M. D., and Wagman, I. H., The Pathway of Sympathetic Nerves to the Ciliary Muscles in the Eye, Amer. Journ. Phynol., 135:759, 1942.

b. Morgan, M. M., Jr., and Olmsted, J. M. D., Response of the Human Lens to a Sudden, Startling Stimulus, Proc. Soc. Exper. Biol. & Med., 42:612, 1939.

c. Morgan, M. W., Jr., Olmsted, J. M. D., and Watrous, W. G., Sympathetic Action in Accommodation for Far Vision, Am. J. Physiol., 128:588, 1940.

d. Morgan, M. W., Jr., Mohney, J., and Olmsted, J. M. D., Astigmatic Accommodation, Arch. of Ophth., 30:247, 1943.

e. Morgan, M. W., Jr., Nervous Control of Accommodation, Amer. J. Optom. & Arch. Amer. Acad. Optom., 21:87, 1944.

f. Olmsted, J. M. D. & Morgan, M. W., Jr., Refraction of the Rabbit's Eye in the Excited State, Amer. J., Phynol., 127:602, 1939.

g. Olmsted, J. M. D., and Morgan, M. W., Jr., The Influence of the Corneal Sympathetic Nerve on the Lens of the Eye, Amer. J. Phynol., 133:720, 1941.

h. Olmsted, J. M. D., The Role of the Autonomic Nervous System in Accommodation for Far and Near Vision, Journ. Nerv. & Ment. Disease, 99:794, 1944.

[14]Wall, G. L., The Vertebrate Eye, Cranbrook Institute of Science, Bloomfield Hills, 1942.

[15]Langley, J. N. and Anderson, H. K., On the Mechanism of Movements of the Iris, Journ. Physiol., 13:554, 1892.

[16]Langworthy, O. and Ortega, L., The Iris, Medicine, 22:287, 1943.

[17]Langworthy, ibid.

[18]Gellhorn, C., Darrow, C. W., and Yesenick, L., Effect of Variation of Blood Pressure on the Autonomic Nervous System, Proc. Soc. Exper. Biol. & Med., 43:236, 1940.

[19]Gellhorn, et al, ibid.

Fig. 1. Ciliary region of the cat. S, sclera, C cornea, I root of iris, P suspensory ligaments, and L lens. From p 683 Walls, "The Vertebrate Eye."

[20]Henderson, T., The Anatomy and Physiology of Accommodation in Mammalia, Trans. Ophth. Soc. United King., 46:280, 1926.

[21]Duane, A., Accommodation, Arch. Ophth., 5:1, 1931.

BIBLIOGRAPHY

Adamük, E. and Woinow, M., Zur Frage über die Accommodation der Presbyopen, Arch. f. Ophth., 16:144, 1870.

Adler, F. H., Clinical Physiology of the Eye, Macmillan, New York, 1933.

Anderson, H. K., Reflex Pupil Dilation by Way of the Sympathetic Nerve, J. Physiol., 30:15, 1903.

Bannister and Pollack, The Accommodation of the Eye, Brit. J. Psychol., 19:394, 1929.

Barrett, J. W., Do Animals Accommodate?, Ophth. Rev., 17:255, 1898.
Accommodation in the Eyes of Mammals, Brit. J. Ophth., 22:148, 1938.

Bates, W. A., The Cure of Imperfect Sight by Treatment Without Glasses, 1920.

Beattie, J., Brow, G., and Long, C., Physiological and Anatomical Evidence for the Existence of Nerve Tracts Connecting the Hypothalamus and the Spinal Sympathetic Centers, Proc. Roy. Soc., B106:253, 1930.

Beer, T., Accommodation in the Animal Kingdom, Ophth. Rev., 17:272, 1898.

Botar, J., Sur les Particularités Structurales des Nerfs Végétatif de l'Oeil, Bull. Assoc. Anat., 15, 1935.

Brown, A. L., A Case Substantiating the Relaxation Theory of Accommodation, Amer. J. Ophth., 11:383, 1928.

Byrnes, J. G., Studies on the Physiology of the Eye, London, H. K. Lewis and Co., Ltd., 1933.
Clark, E., A Further Note of the Influence of Age Upon the Accommodation, Trans. Ophth. Soc. Un. King., 40:260, 1920.
Cobb, S., Hunter and Scarlett, W. A., A Report of 11 Cases of Cervical Sympathetic Nerve Injury Causing the Oculo-pupillary Syndrome, Arch. Neurol. and Psychiat., 3:636, 1920.
Cogan, D. G., Accommodation and the Autonomic Nervous System, Arch. Ophth., 18:739, 1937.
Collins, E. T., Arboreal Life and the Evolution of the Human Eye, Philadelphia, Lew and Febiger, 1922.
Dejean, C., Rechercher sur la Zonule de Zinn, Arch. d'Ophth., 45:65, 1928.
Donders, F. C., Accommodation and Refraction of the Eye, London, 1866.
Duane, A., Studies in Monocular and Binocular Accommodation with Their Clinical Applications, Amer. J. Ophth., 5:865, 1922.
Duane, A., Are the Current Theories of Accommodation Correct?, Amer. J. Ophth., 8:196, 1925.
Duane, A., Subnormal Accommodation, Arch. Ophth., 54:566, 1925.
Duane, A., Accommodation, Arch. Ophth., 5:1, 1931.
Duke-Elder, W. S., Text-book of Ophthalmology, Vol. I, St. Louis, C. V. Mosby, 1938.
Fincham, E. F., The Changes in the Form of the Crystalline Lens in Accommodation, Amer. J. Physiol. Optics, 7:469, 1926.
Fincham, E. F., The Mechanism of Accommodation, London, George Pulman and Sons, Ltd., 1937.
Fischer, F., Ueber Fixirung der Lensenform mittels des Gefriermethode, Arch. f. Augenh., 56:342, 1907.
Fliereinga, H. J., and van der Hoeve, J., Arbeiten aus dem Gebeite der Akkommodation, Graefes Arch. f. Ophth., 114:1, 1924.
Franz, V., Zur Anatomie, Histologie und Funktionellen Gestaltung des Selachierauges, Jena, G. Fisher, 1905.
Fuchs, E., Presbyopia, Arch. Ophth., 51:21, 1922.
Fuchs, E., Ueber den Ciliarmuskel, Graefes Arch. f. Ophth., 120:733, 1928.
Graves, B., The Response of the Lens Capsules in the Act of Accommodation, Trans. Amer. Ophth. Soc., 23:184, 1925.
Graves, B., Change of Tension on the Lens Capsules During Accommodation under the Influence of Various Drugs, Brit. Med. J., 1:46, 1926.
Grossman, K., Further Investigations on Accommodation, Ophth. Rev., 23:1, 347, 1904.
Grossman, K., The Mechanism of Accommodation in Man. Ophth. Rev., 23:1, 1940.
Gullstrand, A., Einführung in d Methoden d Diotrik d Auges, 1911, quoted from Duke-Elder, Text-book of Ophthalmology, Vol. I.
Haller, A., First Lines of Physiology. Translated from 3rd Latin Edition of *Elementa Physiolgiae*, 1743, by Dr. Wm. Cullen, Troy, O. Penneman and Co., 1803.
Hartridge, H., Helmholtz' Theory of Accommodation, Brit. J. Ophth., 9:521, 1925.
Hartridge, H., Yamada, K., and Tokyo, M., Accommodation and Other Optical Properties of the Eye of the Cat, Brit. J. Ophth., 6:481, 1922.
Heath, P., Neosynephrine Hydrochloride: Some Uses and Effects in Ophthalmology, Arch. Ophth., 16:839, 1936.
Heine, L., Physiologisch-anatmische Untersuchungen über die Accommodation des Vogelauges, Arch. f. Ophth., 45(3):469, 1898.
Heine, L., Die Anatomie des Akkommodirten Auges, Arch. f. Ophth., 49(1):1, 1900.
Heine, L., Ein Versuch über Accommodation und Intraokularen Druck am Uberlebenden Kinderauge, Arch. f. Ophth., 60(3):448, 1905.
Helmholtz, H., Ueber die Accommodation des Auges, Arch. f. Ophth., 1(2):1, 1855.
Helmholtz, H., Physiological Optics, 1866., Amer. trans. edited by J. P. C. Southall, Rochester, The Optical Society of America, 1924-25.
Henderson, T., The Mechanism of Accommodation and the Comparative Anatomy of the Ciliary Region, Ophthalmoscope, 10:502, 1912.

Henderson, T., Postural Activity and Evolution of the Ciliary Muscle, Trans. Ophth. Soc. Un. King., 45:521, 1925.
Henderson, T., The Anatomy and Physiology of Accommodation in Mammalia, Trans. Ophth. Soc. Un. King., 46:280, 1926.
Henke, W., Der Mechanismus der Accommodation für Nähe und Ferne, Arch. f. Ophth., 6(2):53, 1860.
Hensen, V., and Völckers, C., Experimental Untersuchung über den Mechanismus der Accommodation, Kiel, Schwarz, 1868.
Hensen, V., and Völckers, C., Ueber die Accommodations bewegung der Choroidea im Auge des Menschen, des Affen und der Katze, Arch. f. Ophth., 19(1):156, 1873.
Hensen, V. and Völckers, C., Ueber den Ursprung der Accommodationsnerven, nebst Memerkungen über die Function der Wurzeln des Nervus Oculomotorus, Arch. f. Ophth., 24(1):1, 1878.
Hess, C., Arbeiten aus dem Gebiete der Accommodationslehre, Arch. f. Ophth., 42(1): 288, 1896.
Hess, C., Ueber die angeblichen Beweise für das Vorkommen Ungleicher Accommodation, Arch. f. Ophth., 42(3):249, 1896.
Hess, C., Arbeiten aus dem Gebiete Accommodationslehre, Arch. f. Ophth., 49:241, 1899.
Hess, C., Vergleichende Untersuchungen über den Einfluss der Accommodation auf den Augendruck in der Werbelthierreihe, Arch. f. Augenh., 63:88, 1909.
Hess, C., Untersuchungen zur Vergleichenden Physiologie und Morgologie des Ciliarringes, Zoologische Jahrbucher Supp., 15, 3:155.
Hess, C. and Heine, L., Arbeiten aus dem Gebiete der Accommodationslehre, Arch. f. Ophth., 46(2):243, 1898.
Hill, L., Blood Vessels and Pressure, Lancet, 198:359, 1920.
Hock, J., Experimentelle Untersuchungen ueber die Wirkung der Mirdeonalen (Langs) Fasern des Ciliar Muskels, Centralbt. f. d. Med. Wiss., 16:769, 1878.
v. Hoeve, J. and Fliereinga, H. J., Arbeiten aus dem Gebiete der Akkommodation, Arch. f. Ophth., 114:1, 1924.
Hudelo, A., Mécanisme de l'Accommodation et Myopie Diabétique, Arch. d'Opth., 47:70, 1930.
Iwanoff, A., Beiträge zur Anatomie des Ciliarmuskels, Arch. f. Ophth., 15(3):284, 1869.
Jegorow, J., Einfluss der Ciliarnerven auf die Pupille, Arch. f. Anat. Phys., 10:149, 1886.
Jessop, M., On the Anatomy, Histology and Physiology of the Intraocular Muscles of Mammals, Proc. Roy. Soc., 40:478, 1866.
Jessop, M., Physiology of the Intra-ocular Muscles, Berlin Period. Internat. Ophth. Cong., 7:188, 1888.
Johnson, L., A New Theory of Accommodation, Arch. Ophth., 52:426, 1924.
Johnson, L., Une Nouvelle Theorie de l'Accommodation, Arch. d'Ophth., 41:746, 1924.
Koke, M. P., Mechanism of Accommodation, Arch. Ophth., 27:950, 1942.
Langenbeck, M. A., Klinische Beitrage aus dem Gebiete der Chirurgie und Ophthalmologie, Gottingen, Dieterische Buchhandlung, 1849-50.
Langley, J. and Anderson, H. K., On the Mechanism of the Movements of the Iris.
Langworthy, O. and Ortega, L., The Iris. Innervation of the Iris of the Albino Rabbit as Related to its Function. Theoretical Discussion of Abnormalities of the Pupils Observed in Man, Medicine, 22:287, 1943.
Leiri, L., Gibt es einen Extralentikularen Akkommodationsmechanismus im Auge?, Graefes Arch., 121:213, 1928.
Loddoni, G., La Zonula di Zinn, Ann. Ottalm., 57:773, 1929.
Luedde, W. H., Mechanism of Accommodation, Amer. J. Ophth., 10:15, 1927.
Luedde, W. H., Hensen's and Völsker's Experiments on the Mechanism of Accommodation, Trans. Amer. Ophth. Soc., 25:250, 1927.
Luedde, W. H., The Mechanism of Accommodation, Trans. Sect. Ophth. A. M. A., p. 357, 1931.
Luedde, W. H., Lenticular Accommodation, Amer. J. Ophth., 19:245, 1936.

Luedde, W. H., What Subluxated Lenses Reveal About the Mechanism of Accommodation, Amer. J. Ophth., 24:40, 1941.
Libby, G. F., A Case of Complete Albinism; Observations on the Changes in the Diameter of the Lens as Seen Through the Iris, Ann. Ophth., 19:245, 1910.
Mannhardt, J., Bemerkoogen über den Accommodationsmuskel und die Accommodation, Arch. f. Ophth., 4(1):269, 1858.
Mohney, J. B., et al, The Pathway of the Sympathetic Nerves to the Ciliary Muscles in the Eye, Amer. J. Physiol., 135:759, 1942.
Morat, J. P. and Doyon, M., Le Grand Sympathique Nerf de l'Accommodation pour la Vision des Objets Éloignés, Ann. d'Ocul., 106:28, 1891.
Morgan, M. W., Jr., and Olmsted, J. M. D., Response of the Human Lens to a Sudden, Startling Stimulus, Proc. Soc. Exper. Biol. and Med., 42:612, 1939.
Morgan, M. W., Jr., Olmsted, J. M. D., and Watrous, W. G., Sympathetic Action in Accommodation for Far Vision, Amer. J. Physiol., 128:588, 1940.
Morgan, M. W., Jr., Mohney, J. B., and Olmsted, J. M. D., Astigmatic Accommodation, Arch. Ophth., 30:247, 1943.
Morgan, M. W., Jr., The Nervous Control of Accommodation, Amer. J. Optom. and Arch. Amer. Acad. Optom., 21:87, 1944.
Neal, H. V., The History of the Eye Muscles, Tuft's College Studies, 4: No. 6, 1918.
Nicolai, C., Ueber den Mechanismus der Accommodation, Klin. Monatsbl. f. Augenh., 94:617, 1935.
Noiszewski, K., Le Mécanisme Hydraulique de l'Accommodation, Arch. d'Ophth., 42:477, 1925.
Obarrio, P., Mechanism of Accommodation Confirmed by Experimental Data, Amer. J. Ophth., 9:90, 1926.
Olmsted, J. M. D. and Morgan, M. W., Jr., Refraction of the Rabbit's Eye in the Unexcited and Excited State, Amer. J. Physiol., 127:602, 1939.
Olmsted, J. M. D. and Morgan, M. W., Jr., The Influence of the Cervical Sympathetic Nerve on the Lens of the Eye, Amer. J. Physiol., 133:720, 1941.
Olmsted, J. M. D., The Role of the Autonomic Nervous System in Accommodation for Far and Near Vision, Journ. Nerv. and Men. Disease, 99:794, 1944.
v. Pflugk, A., Ueber die Akkommodation des Auges der Taube, Weisbaden, 1906.
v. Pflugk, A., Neue Wege zur Erforschung Lehre von der Akkommodation, Arch. f. Ophth., 128:179, 1932.
Poos, F., Ueber den Wirkungsmechanismus der Sympathekurreizmittel auf die Isolierton Iris Muskeln, Klin. Monatsbl. f. Augenh., 77:5, 1926.
Poos, F., Pharmakologische und Physiologische Untersuchungen an den Isolierten Iris Muskeln, Arch. f. Exp. Path., 126:307, 1927.
Poos, F., Zur Frage der Sympathischen Innervation des Ziliarmuskels und Ihrer Bedeutung für die Akkommodation, Klin. Monatsbl. f. Augenh., 80:749, 1928.
Poulain, L. V., Étude sur l'Accommodation de L'Oeil, 1876.
Robertson, C. J., Measurement of the Speed of Adjustment of Eye to Near and Far Vision, Arch. Ophth., 14:82, 1935.
Roelofs, C. O., Betrachtungen über die Myodioptrie Flieringas und van der Hoeses, Graefes Arch. f. Ophth., 115:638, 1925.
Romer, P. and Dufour, O., Experimentelle und Kritische Untersuchungen zur Frage nach dem Influss des Nervus Sympathicus auf den Accommodationsvorgang, Arch. f. Ophth., 54:491, 1902.
Salzmann, M., Anatomy and Histology of the Human Eyeball, University of Chicago Press, 1912.
Schon, W., Zur Aetiologie des Glaucoms, Arch. f. Ophth., 31(4):1, 1885.
Schafer, E. S., Experiments on Cervical Vagus and Sympathetic, Quart. J. Exp. Physiol., 12:231, 1919.
Smith, P., On Accommodation in the Rabbit, Ophth. Rev. 17:287, 1898.
Stilling, J., On the Mechanism of Accommodation, Ophthalmoscope, 10:287, 1912.
Storey, J. B., Anaridia: Notes on Accommodation Changes under Eserine, Trans. Ophth. Soc. Un. King., 44:413, 1924.
Strebel, J., Ueber die Mechanik des Akkommodationsvorganges und die Wirkungsweise der drei Fasersystem des Ciliarmuskels zur Widerlegung der Diskontinuitats-

theorien, Klin. Monatsbl. f. Augenh., 95:235, 1935.
Stuart, T. B., The Function of the Hyaloid Canal and some Other New Points in the Mechanism of the Accommodation of the Eye for Distance, J. Physiol., 31:38, 1904.
Terrien, F. and Camus, J., Influence de l'Excitation du Sympathique Cervical sur l'Ensemble de la Rèfraction de l'Oeil, Arch. d'Ophth., 22:386, 1902.
Trautvetter, D., Ueber den Nerv der Akkommodation, Arch. f. Ophth., 12(1):95, 1866.
Troncoso, M. U., Theories of Accommodation, Amer. J. Ophth., 11:976, 1928.
Tscherning, M. H., Optique Physiologie, 1898.
Tscherning, M. H., The Mechanism of Accommodation, Ophth. Rev., 23:95, 1904.
Tscherning, M. H., Hermann von Helmholtz und die Akkommodationstheorie, Leipzig, J. A. Barth, 1910.
Vogt, A., Ein Wahrscheinlichkeitsbewis für den Helmholtschen Akkommodation-mechanismus, Klin. Monatsbl. f. Augenh., 72:412, 1926.
Walls, G. L., The Vertebrate Eye, Bloomfield, Mich., Cranbrook Press, 1942.
Warlomont, E., Le Muscle Ciliare, Ann. d'Ocul., 73:195, 1875.
Wolfrum, M., Ueber Ursprung und Ansatz der Zonulafasern in menschlichen Auge, Arch. f. Ophth., 69:145, 1908.
Young, T., On the Mechanism of the Eye, Phil. Trans., 19:23, 1801.

CHANGES IN POWER AND AXIS OF CYLINDRICAL ERRORS AFTER CONVERGENCE*

William Beau-Seigneur†
Johnson City, Tennessee

INTRODUCTION

This group of patients is composed of 500 unselected patients between the ages of 18 and 38. This data was compiled to gain information concerning the percentage of patients showing axis or power changes of cylinders upon convergence. The findings were made under normal near conditions with the patient maintaining binocular vision, or whatever condition of the eye was normal to him. J-2 print was used at a distance of 13 inches in all cases with normal visual acuity. The cylinder was checked by three different methods.

Method I—Subjective at near: In the subjective at near, both spherical and cylindrical differences were taken into consideration. In all cases where an increase of cylindrical power at near was noted, the patient was given a choice of additional sphere. However, in each case of change in cylinder power recorded in the data, the cylinder was accepted in preference. The axis was checked by rotating the cylinder until the clearest point was reached. A dynamic subjective was used rather than a foged type as the amount of cylinder varies between the unaccomodated state and the natural accomodated state.

Method II—Cross cylinder at near: 1. A + .50 — .50 and a + .25 — .25 cross cylinder were used as a check for power and axis of cylinder.[1]

In checking for cylinder axis with the cross cylinder, the handle and the mark midway between the red and white dots were held along the cylinder axis and the cross cylinder rotated. The patient was asked to report which face of the cross cylinder made the J-2 print the clearer. When minus cylinders were used, the cylinder axis was rotated a few degrees toward the red dot on the cross cylinder and the axis again checked in the above manner. When the patient finally reported that both faces of the cross cylinder gave equal clarity of print, the axis was recorded.

2. In the check for cylinder power, the dots on the cross cylinder

*Submitted on September 21, 1945 for publication in the March, 1946, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

† Optometrist.

were placed so that they were parallel to the axis of the cylinder. The cross cylinder was then rotated, and the patient was asked which face of the cross cylinder made the print the clearer. If, in the clearer position, the white dots were parallel to the axis, cylinder power in a plus direction was substituted; or, if the red dots were parallel to the axis, cylinder power in a minus direction was substituted.

Method III—Dynamic Retinoscopy: The patient was asked to fixate at the lighted letters at the side of the retinoscope at 13 inches. In this check, a typical dynamic retinoscopy was used. This method was useful in detecting changes of both axis and power between distance and near. However, since these findings are of a gross nature, they are not included in the data.

DATA

This data is taken from a group of five hundred patients:

1. 149 patients, or 29.8% of the group preferred a change of cylinder axis between distance and near.

   a. 123 of the 149 patients, or 24.6% of the group, show *moderate* subjective preference of the new axis for near.

   b. 26 of the 149 patients, or 5.2% of the group, show *definite* subjective preference for a new axis at near point. (The above 26 cases are recorded in Table I.)

2. 23 patients, or 4.6% of the total 500, prefer a *change in cylindrical power* between distance and near. (The above 23 cases are recorded in Table II).

3. 7 patients, or 1.4% of the group, show a near finding which differs in *both power and axis* from the distance prescription. This percentage is included in the percentages given in (b) of Par. 1, and in Par. 2 of the data.

4. 65.6% of the group of 500 patients accepted the same cylinder power and axis at near as at distance.

SUMMARY

We see from the data that 5.2% of the group of 500 *definitely* accept a new axis for near and that 4.6% of the group accept a different cylinder strength at near point. Part of the above percentages probably would be able to wear their distance correction at near point comfortably after becoming accustomed to it; *however a few cases do exist where it would be more advisable to prescribe a separate prescription for near work.*[2 3 4]

The dynamic retinoscope should be used as a method for checking

TABLE I

The following 26 cases are those of the group who are extremely sensitive to the change in axis between distance and near:

Case		Subjective at 20'	Subjective at near point	Cross Cylinder at 13"
1.	O.D.	—1.25 +1.25 X 75	—1.25 +1.25 X 100	—1.25 +1.25 X 100
	O. S.	—1.25 +1.25 X 30	—1.25 +1.25 X 30	—1.25 +1.25 X 30
2.	O.D.	—3.75 +1.75 X 135	—4.25 +3.00 X 145	—4.25 +3.00 X 145
	O. S.	—4.00 +1.25 X 75	—4.25 +2.00 X 60	—4.25 +2.00 X 60
3.	O.D.	—4.50 +2.25 X 90	—4.00 +1.25 X 30	—4.00 +1.25 X 30
	O. S.	—4.50	—4.50	—4.50
4.	O.D.	+1.75 +2.00 X 105	+1.75 +2.00 X 90	+1.75 +2.00 X 90
	O. S.	+2.50 +1.50 X 80	+2.50 +1.50 X 95	+2.50 +1.50 X 95
5.	O.D.	+1.50 X 90	+1.50 X 105	+1.50 X 105
	O. S.	+ .25 + .25 X 90	+ .25 + .25 X 90	+ .25 + .25 X 90
6.	O.D.	— .50 +2.50 X 75	— .50 +2.50 X 90	— .50 +2.50 X 90
	O. S.	— .50 +2.50 X 110	— .50 +2.50 X 120	— .50 +2.50 X 120
7.	O.D.	—1.25 +1.25 X 1.65	—1.25 +1.25 X 10	—1.25 +1.25 X 10
		—1.25 +1.25 X 120	—1.25 +1.25 X 120	—1.25 +1.25 X 120
8.	O.D.	— .25 + .25 X 75	— .25 + .25 X 75	— .25 + .25 X 75
	O. S.	+2.50 X 75	+2.50 X 60	+2.50 X 60
9.	O.D.	—1.25 +1.00 X 45	—1.25 +1.00 X 15	—1.25 +1.00 X 15
	O. S.	—1.00 +1.00 X 180	—1.00 +1.00 X 180	—1.00 +1.00 X 180
10.	O.D.	—2.00 + .75 X 15	—2.00 + .75 X 60	—2.00 + .75 X 60
	O. S.	—2.00 +1.00 X 165	—2.00 +1.00 X 150	—2.00 +1.00 X 150
11.	O.D.	+ .75 +2.50 X 110	+ .75 +2.50 X 100	+ .75 +2.50 X 100
	O. S.	+ .25 +4.00 X 90	+ .25 +4.00 X 90	+ .25 +4.00 X 90
12.	O.D.	+1.75 +2.00 X 105	+1.75 +2.00 X 105	+1.75 +2.00 X 90
	O. S.	+2.50 +1.50 X 80	+2.50 +1.50 X 80	+2.50 +1.50 X 95
13.	O.D.	—4.25 +2.50 X 115	—4.25 +2.50 X 125	—4.25 +2.50 X 125
	O. S.	—4.25 +2.00 X 175	—4.25 +2.00 X 175	—4.25 +2.00 X 175
14.	O.D.	+ .75 +1.25 X 165	+ .75 +1.25 X 130	+ .75 +1.25 X 130
	O. S.	+1.00 +1.00 X 20	+1.00 +1.00 X 10	+1.00 +1.00 X 10
15.	O.D.	+1.00 +1.00 X 150	—1.00 +1.00 X 135	—1.00 +1.00 X 135
	O. S.	—1.25 + .75 X 40	—1.25 + .75 X 70	—1.25 + .75 X 70
16.	O.D.	—2.25 +1.75 X 145	—2.25 +1.75 X 175	—2.25 +1.75 X 175
	O. S.	— .50 +1.50 X 15	— .50 +1.50 X 15	— .50 +1.50 X 15
17.	O.D.	+1.25 +1.00 X 90	+1.25 +1.00 X 108	—1.25 +1.00 X 108
	O. S.	+2.75 +3.25 X 80	+3.25 +3.25 X 95	+2.75 +3.25 X 95
18.	O.D.	+1.25 +1.75 X 180	+1.25 +1.75 X 180	+1.25 +1.75 X 180
	O. S.	+ .50 +1.50 X 170	+ .50 +1.50 X 10	+ .50 +1.50 X 10
19.	O.D.	+1.25 +2.00 X 100	+1.25 +2.00 X 110	+1.25 +2.00 X 110
	O. S.	+1.75 +2.25 X 75	+1.75 +2.25 X 95	+1.75 +2.25 X 95
20.	O.D.	—1.25 +1.25 X 80	—1.25 +1.25 X 80	—1.25 +1.25 X 80
	O. S.	—1.00 +1.00 X 45	—1.00 +1.00 X 65	—1.00 +1.00 X 65
21.	O.D.	+1.75 X 70	+1.75 X 90	+1.75 X 90
	O. S.	+1.50 X 90	+1.50 X 90	+1.50 X 90
22.	O.D.	—3.00 +2.75 X 100	—3.00 +2.75 X 90	—3.00 +2.75 X 90
	O. S.	—4.25 +3.50 X 85	—4.25 +3.50 X 95	—4.25 +3.50 X 95
23.	O.D.	+4.00 +2.75 X 100	+4.00 +2.75 X 120	+4.00 +2.25 X 120
	O. S.	+4.50 +2.25 X 75	+4.25 +2.25 X 75	+4.50 +2.25 X 75
24.	O.D.	—1.00 +3.50 X 110	—1.00 +3.50 X 120	—1.00 +3.50 X 120
	O. S.	— .25 +1.50 X 70	— .25 +1.50 X 80	— .25 +1.50 X 85
25.	O.D.	—3.00 +2.50 X 175	—3.00 +2.50 X 180	—3.00 +2.50 X 180
	O. S.	—1.75 +1.25 X 180	—1.75 +1.25 X 160	—1.75 +1.25 X 160
26.	O.D.	+2.50 +1.75 X 75	+2.50 +1.75 X 75	+2.50 +1.75 X 75
	O. S.	+2.25 +1.50 X 105	+2.25 +1.50 X 125	+2.25 +1.50 X 125

TABLE II

Changes in cylindrical power between distance and near.

Note: The cases displaying both power and axis change and who are extremely sensitive to change are included in both Table I and Table II.

Case	Subjective at 20'	Subjective at near point	Cross cylinder at 13"
1.	O.D. + .25 X 90	+ .75 X 90	+ .75 X 90
	O. S. + .25 X 90	+ .75 X 90	+ .75 X 90
2.	O.D. + .75 X 90	+ .75 X 90	+ .75 X 90
	O. S. + .75 X 90	+1.25 X 90	+1.25 X 90
3.	O.D. —1.75 + .75 X 85	—1.75 +1.25 X 85	—1.75 +1.25 X 85
	O. S. —2.00 + .75 X 95	—2.00 +1.25 X 85	—2.00 +1.25 X 85
4.	O.D. — .25 + .25 X 90	— .25 + .75 X 80	— .25 + .75 X 80
	O. S. —1.25 + .75 X 90	—1.25 +1.25 X 100	—1.25 +1.25 X 100
5.	O.D. +1.25 +3.00 X 110	+1.25 +3.50 X 110	+1.25 +3.50 X 110
	O. S. +1.25 +3.00 X 85	+1.25 +3.50 X 75	+1.25 +3.50 X 75
6.	O.D. —3.75 +1.75 X 135	—4.25 +3.00 X 145	—4.25 +3.00 X 145
	O. S. —4.00 +1.25 X 75	—4.25 +2.00 X 60	—4.25 +2.00 X 60
7.	O.D. + .50 X 105	+ .75 X 105	+ .75 X 110
	O. S. + .25 X 90	+1.25 X 70	+1.00 X 70
8.	O.D. —4.50 +2.25 X 90	—4.00 +1.25 X 30	—4.00 +1.25 X 30
	O. S. —4.50 sphere	—4.50 sphere	—4.50 sphere
9.	O.D. +2.25 +1.25 X 75	+2.25 +2.00 X 85	+2.25 +2.00 X 105
	O. S. +2.00 +1.25 X 95	+2.00 +2.00 X 105	+2.00 +2.00 X 105
10.	O.D. + .75 + .50 X 175	+ .75 +1.00 X 175	+ .75 +1.00 X 175
	O. S. +1.00 + .25 X 180	+1.00 + .75 X 180	+1.00 + .75 X 180
11.	O.D. —1.00 +1.00 X 180	—1.00 + .25 X 180	—1.00 + .25 X 180
	O. S. —1.50 +1.25 X 150	—1.50 + .75 X 150	—1.50 + .75 X 150
12.	O.D. + .25 +1.25 X 165	+ .25 +1.75 X 165	+ .25 +1.75 X 165
	O. S. + .25 +1.25 X 15	+ .25 +1.25 X 15	+ .25 +1.25 X 15
13.	O.D. + .75 + .50 X 110	+1.25 +1.50 X 110	+1.25 +1.50 X 110
	O. S. +1.25 +1.25 X 80	+1.25 +1.25 X 80	+1.25 +1.25 X 80
14.	O.D. — .25 +1.75 X 125	+1.25 X 125	+1.25 X 125
	O. S. + .50 +1.25 X 90	+ .50 +1.50 X 90	+ .50 +1.50 X 90
15.	O.D. +1.00 X 80	+ .25 X 80	+ .25 X 80
	O. S. +1.00 X 85	+ .50 X 85	+ .50 X 85
16.	O.D. + .75 + .75 X 135	+ .75 +1.25 X 135	+ .75 +1.25 X 135
	O. S. + .25 +1.50 X 135	+ .75 +1.50 X 135	+ .25 +1.50 X 135
17.	O.D. —1.50 +1.00 X 15	—1.50 +1.50 X 15	—1.50 +1.50 X 15
	O. S. — .75 +1.00 X 165	— .75 +1.75 X 165	— .75 +1.75 X 165
18.	O.D. +2.75 +2.00 X 75	+2.75 +2.75 X 75	+2.75 +2.75 X 85
	O. S. +3.25 +1.75 X 100	+3.25 +2.00 X 100	+3.25 +2.00 X 100
19.	O.D. + .75 X 80	+ .25 X 80	+ .25 X 80
	O. S. +1.00 X 95	+ .50 X 95	+ .50 X 95
20.	O.D. — .75 + .75 X 90	— .75 +1.25 X 90	— .75 +1.25 X 90
	O. S. — .25 + .75 X 90	— .25 + .75 X 90	— .25 + .75 X 90
21.	O.D. + .25 +1.25 X 30	+ .25 +1.75 X 30	+ .25 +1.75 X 30
	O. S. + .25 + .50 X 120	+ .25 +1.50 X 120	+ .25 +1.50 X 120
22.	O.D. + .75 +1.25 X 135	+ .75 + .75 X 135	+ .75 + .75 X 135
	O. S. +1.50 + .75 X 45	+1.50 + .25 X 45	+1.50 + .25 X 45
23.	O.D. + .75 X 180	+1.50 X 180	+1.50 X 180
	O. S. +1.25 X 180	+2.00 X 180	+2.00 X 180

change in power and axis after convergence in every refraction as it furnishes a quick method for detection of whether a change in cylindrical power or axis takes place between distance and near. When a notable difference is detected, a refining of the finding can be made with the Jackson cross cylinder and the subjective at near point.

The change of cylinder power and axis at near point would also have a bearing on the cross cylinder findings at near in which a grid is used. This could partially account for the inability of some patients to obtain equality of the vertical and horizontal lines of the cross cylinder grid, even after sufficient plus has been added to bring equality.

The discrepancy between distance and near cylinder is usually compensated for in uncorrected pre-presbyopes by the accommodative action of the crystalline lens, which with the added cylinder establishes a conus of least confusion about the retina.

An experiment illustrating this may be performed by placing a +1.50 x 90 cylinder before the corrected eye of the non-presbyope and viewing the print at twenty feet. As a result, the letters on the chart will be blurred several lines. However, upon viewing the print at near through the same +1.50 x 90, corresponding change cannot be noted in the clarity of the near print. This indicates that a compensating spherical action by the crystalline lens must have taken place; an action which forms a circle of least confusion with the amount of axis of the new cylinder found at near.

As indicated by the above experiment, quite a bit of cylinder power change can take place upon convergence, yet still go unnoticed in the subjective answers of the patient. For this reason, the examiner might be inclined to believe that no change had taken place. However, as these cylindrical power changes are slight, it is quite possible that they are masked under the spherical component added by the crystalline lens in the form of a circle of least confusion which is preferred to a point focus. *This may account for the frequent change in axis of cylinder with no apparent associated power change.*

The preceding experiment may be conversely borne out by placing a 2.50 diopter lens before the corrected eye and viewing a near point card placed at the focal length of the 2.50 diopter lens, so that accommodation is completely relaxed When a +1.50 x 90 cylinder is placed before the 2.50 diopter, a blur in the print of the near point card is obtained which approximates that obtained on the distance chart with the 2.50 diopter lens removed. This further supports the contention that a conus

of least confusion is formed between the spherical component added by the crystalline lens and the total cylindrical error present.

The compensating action of the lens, in itself, probably changes the amount and axis of the near cylinder a slight amount. In any case, however, a spherical balance with the total cylindrical error is formed, which places a conus of least confusion about the retina.

In the resultant finding at near (Table II), it may be noted that some cases prefer less cylinder on near findings than on distance findings, while others show more cylinder at near than at distance. It is probable that the patients showing more cylinder on the distance prescription than on the near prefer a conus of least confusion at the near point, while those showing less cylinder at distance than at near prefer a conus of least confusion at distance. The majority of the cases in Tables I and II of the data prefer a point focus at both distance and near, or a similar conus of least confusion at both distance and near. The amount of sphere changed and the amount of cylinder reduced by forming the circle of least confusion probably conform closely to the rule of spherical equivalents as Copeland[5] suggests.

Some theoretical explanations for the change in cylindrical power and axis between distance and near are as follows:

1. Apparent change in cylinder after convergence due to the subjective preference of a point focus at distance and a circle of least confusion at near, or in some cases, a circle of least confusion at distance and a point focus at near. (Example 6, Table II). This apparent change might account for some of the cases of change of power or axis of cylinder before and after convergence.

2. Lenticular astigmatism.

a. Lenticular astigmatism due to more action of the ciliary muscle in one meridian than in another meridian. Work on this subject was done in 1868 by Dobrowolski. It is mentioned, but not agreed with by Duke-Elder.[6]

In an experiment conducted on animals by M. W. Morgan, Jr.,[7] instructor at the University of California, it has been found that a lenticular astigmia with the rule is usually created by excess stimulation from the sympathetic nervous system to the radial fibers of the ciliary muscle; while an against the rule astigmatism is usually created by an over stimulation of the parasympathetic to the circular fibers of the ciliary muscle. These changes were detected by means of the retinoscope. Morgan says that the definite stimulation of an area is due to the fairly sharp demarcation in the area of muscle supplied by each nerve.

This astigmatic effect was also noticed by Grossman[8] in 1904. A

number of other works have been written by Olmsted, Morgan, and Watrous,[9] Koke,[10] Olmsted,[11] which have a bearing on this subject.

This might lead us to believe that excess stimulation over the third nerve to the internal rectus could produce an against the rule astigmatism in some cases, especially if an excess of convergence effort is necessary to bring about binocular vision at near. This against the rule astigmatism does not seem to be especially apparent in the cases of change in power recorded in Table II; however, it must be borne in mind that the refracting system of the eye is made up of different surfaces and media, and the change in one or more of these will influence the total refracting power, so that the change mentioned might not necessarily be apparent.

b. Lenticular astigmatism caused by defects in the zonular fibers, allowing an uneven tension to be exerted on the capsule,[2] and by differences in the elasticity of the individual zonules.

c. Lenticular astigmatism caused by inequality of density of a particular portion of the lens; for example, a small cataract, or the cortical hardening found in the lens of the incipient presbyope. This variation in structure could cause the lens to refract irregularly when the tension of the lens capsule changes from a position of infinity to a position of near.

d. Deformities in shape of the lens which would give an astigmatism when tension on the capsule is relaxed.

e. Astigmatism caused by the pulling of the crystalline lens a little off center with the visual axis by the act of accomodation.

Lenticular astigmatism probably accounts for the largest portion of the cylindrical changes in power between distance and near.

3. Small changes in general shape of the cornea, lens, or axial length of the whole eye due to an increase of tension on the eye by extrinsic muscles.

The fact that there is a slight tension on the eye at near is demonstrated by the average physiological exophoria found at near. As the exophoria at near increases, the tension exerted on the eye at near point would likewise increase. An experiment for obtaining an estimation of the amount of tension necessary to affect the refractive power may be obtained by applying a light pressure with the finger tips to the sclera through the lower lid. This will cause a blur to occur in the average individual.

It may be noted that when pressure is applied near the limbus the most blur is observed. No doubt this is due to a slight change in radius of curvature of the cornea, as an infinitesimal change in the radius would make a blur apparent due to the high refractive power generated between air and the cornea. Might we then contemplate the possibility that con-

vergence might likewise minutely change the radius of curvature of the cornea?[3] This change is denied by most authorities; however, if it does take place, it should be possible to obtain evidence of it with the ophthalmometer.

The amount of pressure necessary to cause the blur to take place would vary with the toughness of the sclera and the cornea of the individual and the distance away from the cornea that the pressure is applied.

Another possible change that some men believe takes place could be in the over-all shape of the eye.

Since the vitreous may be considered a fluid, the pressure applied to the sclera would be equally transmitted to all parts of the vitreous. Since 1/3 of a mm.[12] change in position of the retina will vary the power of the eye approximately one diopter, when of average refractive power, the change in the length of the eye could be very minute and still cause an appreciable blur.

Another interesting fact is noted in the individuals who seemingly retain a slight amount of lenticular movement despite carefully given cycloplegics. In 50 patients who had been given 1% atropin by a medical doctor and refracted by the author, it was found that 12 patients displayed a small difference in refractive power after convergence. The atropin was given daily over a period of no less than 3 days, in one eye only. This difference was noted with the retinoscope when the patient was asked to look at the dynamic figures on the retinoscope. The patient was able to concentrate his gaze directly on the figures of the retinoscope as cycloplegia was present in only one eye. It was also noted in some cases when the retinoscope was moved away from the midline, fixation maintained on the retinoscope, slight changes in power resulted in the atropinized eye.

The changes in power and axis between distance and near while under atropin are recorded below:

Amount of power change between distance and near retinoscopic findings	Shift of axis between distance and near retinoscopic findings
1. + .25 + .50 × 90	1. 20°
2. + .50 + .25 × 90	2. 15°
3. + .50 + .25 × 100	3. 25°
4. + .25 × 120	4. 50°
5. + .50 × 90	5. None
6. + .25 + .25 × 105	6. 80°
7. + .25	7. None
8. + .25 × 80	8. 15°
9. + 25 + .25 × 70	9. None
10. + .25 + .37 × 175	10. 15°
11. + .37 + .25 × 75	11. 15°
12. + .25 × 75	12. None

In the above cases where atropin was used, cycloplegia should be complete; however, the slight difference in power and axis noted above exists between distance and near when convergence is exerted. These changes are the measurement of an increase in hyperopia which indicates a placement of focus behind the retina. *This is contrary to what would be expected if the length of the eye were increased.* We may then consider it probable that no change takes place in the length of the eye, due to compression of the extrinsic muscles. Factors other than compression by the extrinsic muscles may explain the variation under atropin. Cogan[13] suggests that atropinization allows a cramp-like contraction of the radial fibers of the ciliary muscle to take place. Cogan is in agreement with Morgan and Olmsted concerning the theory, previously mentioned in Part (a) of 2, that there is sympathetic innervation to the radial fibers of the ciliary muscle.

The theory that distance posture of the lens is obtained by aid of the sympathetic supplied radial fibers pulling on the zonules, as well as by the elasticity of the ciliary body, is supported by many including Cogan, Byrne,[14] and by Pearcy and Allen,[15] who conducted experiments on this subject on man. Cogan suggests that atropin renders inate acetylcholine, a substance necessary to parasympathetic nerve action, but leaves the sympathetic innervation to the radial fibers free to exert an unopposed tension on the zonules. This renders the lens less convex, thereby increasing hyperopia. It is this uninhibited action of the sympathetic which causes the increase in hyperopia noted under cycloplegia. The lack of increase in hyperopia in the myope who is under cycloplegia is explained by assuming that the uncorrected myope is constantly allowing maximum action of the sympathetic supplied radial fibers, so as to obtain the least convexity, and, consequently, the clearest possible vision. For this reason, no additional free action would be noted in the myope under cycloplegia.

Another factor involved, which we might consider as being a result of an underacting sympathetic innervation to the radial fibers, are some cases of pseudomyopia, as the zonules would not have sufficient tension to render the lens less convex enough to obtain clear distance vision.

It might be interesting to note that a large portion of the cylindric changes between distance and near, in the previously listed atropinized cases, are with-the-rule. This could be in accordance with the with-the-rule astigmia noted by Grossman and Morgan, as previously mentioned in Part (a) of 2.

4. Change in effective power of cylinders due to their use of other

distances than infinity. This change is unappreciable in cylinders of less than 5 diopters.

5. Tortional effects might be suspected in the group of patients that show low axis changes and little, or no power changes. The slight rotation of the whole eye due to tortional effects of the extrinsic muscles (Cyclophoria) probably accounts for the greatest percentage of the cases in Part (2) of 1 of the data. The subject of angle of tortion has been discussed by many, including J. P. C. Southall, [16] and W. D. Zoethout.[17]

CONCLUSION

1. That the change in cylindrical power and axis takes place between distance and near in many cases.

2. That a circle of least confusion is automatically formed in the uncorrected eye at near between the total cylindrical error and the spherical power added by the crystalline lens.

Due to this fact, even though a cylindrical change between distance and near is present, the patient may still be perfectly comfortable.

3. That a method for detecting appreciable cylindric changes between distance and near should be used in the routine refraction. The dynamic retinoscope would seem to answer this purpose of rapid detection of gross change, while the Jackson cross cylinder check and a subjective at near would be used for accurate determination of the preferred cylinder at near.

4. That some cases of cylindrical change between distance and near exist in which a person would be more comfortable if fitted with a separate correction at near, or in the average case, a distance correction of such a cylindric strength as to give a comfortable conus of least confusion at near point, as well as at distance.

334 E. MAIN ST.
JOHNSON CITY, TENN.

REFERENCES

1. Jackson, E.: How to Use the Cross Cylinder, Am. J. Ophth. 13:321, 1930
2. Hughes, Wendell, L.: Changes in Axis of Astigmatism on Accommodation, Arch. Ophth. 26:742 (Nov.) 1941.
3. Pascal, J. I.: Axis of Astigmatism, Arch. Ophth. 27:189 (Jan.) 1942.
4. Sugar, S. H.: Binocular Refraction, Arch. Ophth. 31:34 (Jan.) 1944.
5. Copeland, J. C.: A Study in the Application of Cylindrical Corrections, Optometric Weekly, 19:191 (April) 1928.
6. Duke-Elder, W. S.: Text Book of Ophth., Vol. 1, p. 749.
7. Morgan, M. W., Jr.: Nervous Control of Accommodation, Am. J. Optometry, Vol. 21:87 (March) 1944.
8. Grossman, K.: Further Investigations on Accommodation, Ophth. Review, 23:1, 347, 1904.

9. Olmsted, J. M. D., Morgan, M. W. Jr., and Watrous, W. G.: Sympathetic Action in Accommodation for Far Vision, Am. J. Physiology, 128:588, 1940.
10. Koke, Martin P.: Mechanism of Accommodation, Arch. Ophth. 27:950 (May) 1942.
11. Olmsted, J. M. D.: The Role of Autonomic Nervous System in Accommodation for Far and Near Vision. Jour. Nervous and Mental Dis., 99:794 (May) 1944.
12. Lawrence and Wood.:T. B.—Visual Optics and Sight Testing, 4th Edition, p. 119.
13. Cogan: Accommodation and the Autonomic Nervous System, Arch. Ophth., 18:739, 1937.
14. Byrne: Studies on Physiology of the Eye, London, H. K. Lewis & Co., Ltd. 1933.
15. Pearcy, J. F., and Allen, T. D.: Studies on the Visceral Nervous System: Reflexes From the Gastro Intestinal Tract to the Eye. Am. J. Physiology 82:36, 1927.
16. Southall, J. P. C.: T. B.—Introduction to Physiological Optics. p. 164-186.
17. Zoethout, W. D.: T. B. Physiological Optics, p. 310.

AMERICAN JOURNAL OF OPTOMETRY
and ARCHIVES *of*
AMERICAN ACADEMY OF OPTOMETRY

Established 1924

Vol. 23 MARCH, 1946 No. 3

EDITORS AND STAFF

Dr. Carel C. Koch . . . . . Editor, Publisher and Academy Secretary
Dr. Clarence W. Morris . . . . . Associate Editor
Dr. Rudolph H. Ehrenberg . . . . . Associate Editor
Dr. J. Fred Andreae . . . . . President, American Academy of Optometry
A. Virginia Huck . . . . . Editorial Assistant
Harry Brookins . . . . . Advertising and Production Manager
L. L. Koch . . . . . Circulation Manager

Publication and Academy Office: 1502 Foshay Tower, 821 Marquette Ave.
Minneapolis 2, Minnesota

Annual Subscription, $5.00 in Advance; Canada, $5.50; Foreign, $6.00;
Single Copies, 50c.

Original papers, scientific communications, clinical reports, books for review, and correspondence should be sent to the editor. Subscriptions and applications for single copies should be addressed to the circulation manager. Copy of advertisements must be sent in by the first of the month preceding their appearance. Communications with reference to advertising or other journal business should be addressed to the advertising manager. Academy correspondence should be addressed to the Secretary of the American Academy of Optometry.

Published Monthly by the
AMERICAN JOURNAL OF OPTOMETRY PUBLISHING ASSOCIATION

The American Academy of Optometry and the publishers of this journal have no objection to the reprinting by other magazines of any of the articles in this issue, provided such reprints are properly credited to the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

PACIFIC UNIVERSITY COLLEGE OF OPTOMETRY ACCREDITED

According to the A. O. A. Public Health Bureau, the Council on Education of the American Optometric Association has accredited Pacific University College of Optometry at Forest Grove, Oregon. After the necessary inspection trips, it was decided that this university was a worthy addition to the already accredited schools and colleges of Optometry.

The Oregon Optometric Association, it is reported, is responsible for the establishment of this College of Optometry. The physical equip-

ment and the charter of the North Pacific College of Optometry was transferred to Pacific University and in September, 1945, thirty students were enrolled in Optometry.

The five-year course, listed below, may be accelerated in order that it can be completed in four calendar years by taking summer work. At the end of the fourth year, the Bachelor of Science Degree is conferred, and at the end of the fifth year, the Doctor of Optometry Degree is granted by the University.

	FIRST YEAR (Pre-Optometry)		
Elementary Analysis	4	Elementary Analysis	4
General Chemistry	4	General Biology (Zoology)	4
English Composition	2	English Composition	2
History (American or European)	3	History (American or European)	3
Economics or Sociology	3	Economics or Sociology	3
Physical Education	1	Physical Education	1
	17		17
	SECOND YEAR		
Physics	4	Physics	4
Literature	3	Literature	3
General Psychology	2	General Psychology	2
Comparative Anatomy	4	Human Physiology	4
Mechanical Optics	2	Mechanical Optics	2
Physical Education	1	Physical Education	1
	16		16
	THIRD YEAR		
Human Anatomy	3	Ocular Anatomy	3
Geometrical Optics	3	Geometrical Optics	3
Physical Optics	4	General Bacteriology	4
Histology	3	Pathology	3
Physiological Optics	3	Physiological Optics	3
	16		16
	FOURTH YEAR		
Psychology of Vision	4	Psychology of Vision	4
Ocular Pathology	2	Ocular Pathology	2
Theoretical Optometry	4	Theoretical Optometry	4
Instrumentation	1	Instrumentation	1
Visual Fields	2	Visual Training	2
Electives (Rel)	2	Electives (Rel)	2
	15		15
	FIFTH YEAR		
Clinical Optometry	5	Clinical Optometry	5
Applied Pathology of the Eye	1	Applied Pathology of the Eye	2
Contact Lens and Subnormal Visual Devices	3	Opt. Econ. and Jurisprudence	3
Advanced Optometry	4	Advanced Optometry	4
Speech	2	Comprehensive Review Course	3
Visual Problems of School and Industry	2		17
	17		

According to the Public Health Bureau, Pacific University had its beginnings in a Congregational missionary school begun in 1841 by the Rev. Harvey Clark and his wife in a log cabin on the site of the present campus. In 1847, Mrs. Tabitha Brown came to Tualatin Valley, and seeing a need among the orphaned children of the pioneers, organized a boarding school in the same log cabin, with the help of Mr. Clark. Later in the same year, Dr. George Atkinson came to Oregon, having been commissioned by the Home Missionary Society to extend religious work and advised by the American College and Educational Society to "found an academy which shall grow into a college." The territorial legislature granted a charter in 1849 for "a seminary of learning for the instruction of both sexes in science and literature, to be called Tualatin Academy." In 1853, Dr. Atkinson felt that the time had come for the academy to "grow into a college." The next year he secured as president of the proposed college, the Rev. Sidney Harper Marsh, of Union Theological Seminary, New York, under whose leadership a charter was granted to "Tualatin Academy and Pacific University." It grew under this name until 1914, when the academy was discontinued.

Dr. W. C. Giersbach is now President of Pacific University, and Dr. Cyril K. Gloyn, Vice-President. Interested students should write to Dr. M. O. Skarsten, Director of Admissions, for information.

All the courses, except the professional optometric course, will be taught in the regularly established departments of the university. The following faculty members have been appointed to teach professional subjects in the College of Optometry: Drs. Caryl Groisant, Carol B. Pratt, R. B. Clunes, C. G. Carkner. Others will be added as the program develops.

H. WARD EWALT, JR.

DATES SET FOR ANNUAL MEETING OF ACADEMY

The Executive Council of the American Academy of Optometry has announced the dates for the 1946 Annual Meeting. These are December 1, 2, 3 and 4, with the meeting place being Philadelphia. Members of the Academy should now start laying their plans to attend this Annual Meeting. The program will be under the general supervision of Dr. D. G. Hummel.

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

REPORT OF THE RESEARCH PROJECTS COMMITTEE OF THE AMERICAN ACADEMY OF OPTOMETRY

(for the period January—December 1945)

Robert E. Bannon, Chairman, Hanover, New Hampshire

I. PURPOSE

The purpose of this committee is stated in Memo. No. 5 (January 20, 1945) from Carel C. Koch to the Executive Council: " . . . a committee to make recommendations to the Executive Council on matters having to do with optometric research. It is not expected that the committee itself engage in research work, but rather that the committee arrange that specific research problems are studied by persons capable of conducting these studies in suitable educational centers and that the Academy assist in the financing of these research activities through the allocation of Academy funds which will be appropriated for this purpose by the Executive Council."

II. MEMBERS

The members appointed to this committee by Chairman Bannon were: Julius Neumueller, Glenn Fry, Richard Hall, and Richard Feinberg.

III. ACTIVITIES

1. The committee recommended to the Executive Council that the Academy give financial support, to the extent of $500, for research to be conducted by Dr. Meredith Morgan of the University of California. The projects suggested by Dr. Morgan and agreed upon by the committee were:
   a. An investigation of techniques employing stereoscopic targets for the orthoptic treatment of binocular anomalies.

   Dr. Morgan has reported (November 21, 1945): "This project has been under way since the beginning of August. Last semester we had some 46 subjects given orthoptics. To date I have not carefully analyzed the data other than in a general way."

b. Investigation of the direction and final resting place of the visual axes when fusion is broken as in duction and fusional reserve tests.

Dr. Morgan has reported (November 21, 1945): "This is completed and as soon as I have time a written report will be sent to Dr. Koch."

c. Investigation of the Longworthy & Gelhorn Theories of pupillary dilation.

Dr. Morgan has reported (November 21, 1945): "This problem has expanded into a 'New Theory of the Control of Accommodation'. While the work is not finished it is sufficiently advanced to report upon. I plan to give this report in person at the Academy meeting in Columbus."

Dr. Morgan stated further that: "To date some $366 of the original $500 grant has been used."

The Committee on Research Projects, as well as the Academy as a whole, is proud of the opportunity to assist in some small way the research which Dr. Morgan has carried out. It should be pointed out that the extent of the Academy's financial support does not serve, in the slightest degree, as a criterion of the total cost of Dr. Morgan's projects, of the value of his and his assistant's time, and the many other important factors which go into a research problem. The Academy funds were used solely for the purchase of material not already available but necessary for the specific project.

(Much more could be said on this subject because it seems that some believe that "Academy support" means full and complete payment by the Academy of all expenses. This is not the time nor place to elaborate on this misinterpretation —except to say, it is definitely incorrect.)

The Committee on Research Projects wish to thank Dr. Morgan for his excellent work and his fine cooperation. We hope that Dr. Morgan will permit the Academy next year to share again in the expense and in the honor of some of his projects.

2. The committee studied and agreed upon a number of research projects which were submitted for publication in the June, 1945 issue of the American Journal of Optometry and

Archives of American Academy of Optometry. These projects were as follows:

(1). An Adequate History of the Development of Concepts and Terms Applicable to Accommodation and Convergence.

(2). Specifications of Position of Lenses Mounted Before the Eyes.

(3). Nomenclature in Spatial Perception.

(4). An Investigation of the Significance of Anomalous Phoria and Fusional Amplitude Findings.

(5). Industrial Vision Research.

It was proposed that a sum of money ($1000) be set aside to encourage and support anyone interested in working on any of the suggested projects. Applicants were advised to contact Dr. Carel Koch. As far as the committee knows, Dr. Koch has had no inquiries.

In the exchange of correspondence between committee members it was pointed out that perhaps a better way to encourage research would be to suggest that the person interested might name his own project and/or a fund be set up for a post-graduate scholarship. These and other ideas may be tried next year by the committee appointed by the President of the Academy.

3. Following an inquiry from President Andreae in August regarding any further research projects, the writer proposed a project on: "Refractive Findings Obtained Without and With the Use of Cycloplegics". This project with a detailed outline was submitted to the Committee on Research Projects and, to date, one member has not voted; two members are for; and two members are against recommending Academy financial support. It, therefore, seems advisable to table this project until next year or withdraw it entirely—whichever the committee and/or the President decides.

CONCLUSION—I want to say that this committee has only begun to encourage cooperation between research-minded men and the Ameriacn Academy of Optometry. Much remains to be done and I and my fellow members hope that the committee appointed for next

year will succeed where we have failed in encouraging many more men to engage in research and to seek partial financial support from the Academy. Toward this end, I would suggest that the committee be made smaller (viz, three rather than five) in order to facilitate more rapid correspondence and decisions.

I want to thank the members of my committee for their cooperation and valued advice. As mentioned before, but it merits repeating, we all appreciate especially the fine work of Dr. Meredith Morgan.

ACADEMY COMMITTEE APPOINTMENTS

EDITORIAL COUNCIL

Dr. J. Fred Andreae, President of the American Academy of Optometry has appointed the following members of the Academy to the Editorial Council to serve in conjunction with Dr. Carel C. Koch of the Executive Council for the year 1946: Dr. J. Fred Andreae, Dr. Robert E. Bannon, Dr. Harold M. Fisher, Dr. Glenn A. Fry, Dr. Richard M. Hall, Dr. Elmer E. Hotaling, Dr. Dan G. Hummel, Dr. Julius Neumueller, Dr. Don R. Paine, Dr. Ernest Petry, Dr. E. LeRoy Ryer and Dr. Arthur P. Wheelock.

COMMITTEE ON RESEARCH PROJECTS

Dr. J. Fred Andreae, President of the American Academy of Optometry has appointed the following members of the Academy to the Committee on Research Projects for the year 1946: Dr. Robert E. Bannon, Chairman, Dr. Glenn A. Fry, Dr. Richard M. Hall and Dr. Julius Neumueller.

ACADEMY SPEAKERS BUREAU

Dr. J. Fred Andreae, President of the American Academy of Optometry has appointed the following members of the Academy to the Speakers Bureau for the year 1946: Dr. Richard Feinberg, Chairman, Dr. Ernest Hutchinson, Dr. Lewis Kraskin, Dr. E. Freeman and Dr. C. A. Radde.

COMMITTEE ON NOMENCLATURE AND STANDARDS

Dr. J. Fred Andreae, President of the American Academy of Optometry has appointed the following members of the Academy to the Committee on Nomenclature and Standards for the year 1946: Dr. Glenn A. Fry, Chairman, Dr. E. L. Higgins, Dr. C. A. Radde, Dr. C. L. Treleaven, and Dr. Rita Walsh.

ADVISORY BOARD

Dr. J. Fred Andreae, President of the American Academy of Optometry has appointed the following members of the Academy to the Advisory Board for the year 1946: Dr. Arthur P. Wheelock, Chairman, Dr. I. Borish, Dr. Harry L. Fuog and Dr. Don R. Paine.

MARYLAND CHAPTER

The Maryland Chapter of the American Academy of Optometry met Wednesday, January 30, 1946 at the Stafford Hotel, Baltimore, Maryland. Mrs. Virginia Star Freedom, a political science commentator, was the guest speaker and her subject was "A Look Into the Next Ten Years". Academy members from Maryland, Delaware, and the District of Columbia attended this meeting.

SOUTHERN CALIFORNIA CHAPTER

The Southern California Chapter of the American Academy of Optometry met Friday, December 14, 1945 at the Los Angeles Athletic Club, Los Angeles, California. Dr. Richard Ernest Wollrath, Physicist, was the first speaker. Dr. Wolrath's subject was Atomic Energy. Mr. L. Van Lear then spoke on the application of coating to ophthalmic lenses to reduce reflections. Dr. Ernest Hutchinson, President of the Chapter acted as presiding officer.

This Chapter also met on January 11, 1946 at the Los Angeles Athletic Club, Los Angeles. Dr. Arthur Hoare was the first speaker, reviewing the Twenty-second Annual Meeting of the American Academy of Optometry at Columbus. Commander Ralph Coops, U. S. N. R. then spoke on Optometry in the Navy.

ANNOUNCEMENTS

REFRESHER COURSES IN OPTOMETRY

offered at
The School of Optometry
The Ohio State University
Columbus, Ohio

The program outlined below is offered primarily to meet the needs of optometrists returning from military service but is open to all optometrists. The refresher courses will be taught concurrently with the regular

courses in the optometry curriculum, i. e., beginning and ending with the calendar dates of the spring quarter. The spring quarter begins March 26, and ends June 10, 1946. The program recommended for returnees to follow will include three special refresher courses, and two courses in the regular optometry curriculum as follows:

Optometry 591. Special refresher course. No credit. Review of theory and techniques of keratometry, skiametry, subjective tests of refraction and accommodation and functions of the extraocular muscles, systematic analysis of anomalous conditions with special reference to etiology and corrective procedure. Five lectures and recitations, and two three-hour laboratory (clinical) periods each week. Dr. Haines, Dr. Bridgman, Dr. Hofstetter, and assistants.

Optometry 592. Special refresher course. No credit. Theory and practice of fitting contact lenses. One lecture or recitation, or one two-hour laboratory period each week. Dr. Bridgman.

Optometry 593. Special refresher course. No credit. Review of the theory and practice of orthoptic and visual training. One lecture or recitation, or one two-hour laboratory period each week. Dr. Hofstetter.

Optometry 557. Applied Pathology of the Eye. Theory and methods of testing for and differentiating visual field anomalies of the eye. Two lectures or recitations, and one two-hour laboratory period each week. Dr. Bridgman.

Optometry 563. Civic, National, and Professional Problems in Eye Care. Prevalence of visual anomalies, relation of available practitioners to the total needs for eye care, relation of optometry to other groups concerned with eye care, problems in providing eye care for people with low incomes, etc. Two lecture hours each week. Dr. Hofstetter.

The schedule of hours for classes and laboratories will be arranged to prevent conflicts of meeting times for courses included in the above recommended program.

The students registering for the above program will be listed as special students for refresher courses in optometry. Students classified as residents of Ohio will pay $150.00 quarterly fees, and non-residents will pay $200.00. The offering of the refresher courses will be subject to a minimum registration of 12 students.

Equipment that must be provided by the student for his own use will include a hand ophthalmoscope, retinoscope, monocular cross cylinders, clinic apparel, textbooks, and incidentals.

Applications for admission to the optometry refresher program should be sent to:

THE SCHOOL OF OPTOMETRY
THE OHIO STATE UNIVERSITY
COLUMBUS 10, OHIO

and should include the following information:

1. Name.
2. Professional training (name of school, degree, date).

3. Professional license (state, registration number, and date).
4. Military status (rank or rating held and division of service).
5. Home address prior to entering military service.
6. Citizenship status.

Those not wishing to follow this program in its entirety may select any part of the program, without a reduction in fee. Those wishing to take work for credit toward a degree must make application to the Entrance Board for admission to the School of Optometry in the regular manner, submitting transcripts of credits received from other schools, etc. Those wishing to audit other regular courses offered in the university, or wishing to participate in other departmental refresher programs, e. g. mathematics, should make specific requests for information to the Entrance Board. Those qualified for graduate work in physiological optics or visual science and wishing to follow a program leading to an advanced degree, should send their requests to Dr. Glenn A. Fry for arrangement of a program of study in the Graduate School.

FORTY-NINTH ANNUAL MEETING OF THE AMERICAN OPTOMETRIC ASSOCIATION

The 49th annual meeting of the American Optometric Association will be held at the William Penn Hotel in Pittsburgh, July 7-8-9-10, 1946.

Dr. H. Ward Ewalt, Jr. has been appointed General Chairman, and the chairmen of the various committees are as follows: Registration, Dr. E. P. Schempp; Hotel, Dr. Joseph Mullin; Publicity, Dr. E. M. Soles; Entertainment, Dr. E. H. Westland; Education, Dr. H. S. Kane; Reception, Dr. H. Schreiber; Program, Dr. Lewis Soles; Transportation, Dr. A. Herring; Display, Dr. William J. Van Essen; Financial, Dr. E. A. Picard. Convention Committee Headquarters have been established at 707 Jenkins Building, Pittsburgh 22, Pennsylvania.

Hotels are crowded from coast to coast. Pittsburgh is no exception. However, the Pittsburgh Convention Bureau will serve as a central housing agency, which will assure efficient handling of reservations. Hotels will not honor reservations sent direct. Hotel reservation and convention registration forms will be available early in March. Detailed plans for your comfort and convenience will insure your pleasure on the trip to the Golden Triangle.

CALIFORNIA STATE ASSOCIATION OF OPTOMETRISTS

The Annual Convention of the California State Association of Optometrists will be held at the Californian Hotel, Fresno, on Friday,

Saturday and Sunday, April 5, 6 and 7, 1946, to be preceded by a meeting of the Association's Board of Directors, Thursday, April 4.

QUARTERLY MEETING OF BETTER VISION INSTITUTE

The Better Vision Institute held its quarterly meeting at the Park Lane Hotel, New York City, on Friday, January 18th. Members of all branches of the optical industry and of professional groups were present, as well as several prominent guests. The Institute Directors unanimously endorsed the continuance of the BVI advertising program in 1946 upon the same scale as in 1945. In accordance with established Institute policy, these educational advertisements will continue to reach the public through large-circulation national publications. The Saturday Evening Post, Life, American Magazine, Farm Journal, and MacLean's of Canada will again be used; and to these have been added for 1946 the Ladies' Home Journal, and Hygeia. These magazines together provide a net circulation of over 19,000,000 copies, and a total readership circulation several times that figure.

NEW ENGLAND COUNCIL OF OPTOMETRISTS

The Twenty-fifth Annual Meeting of the New England Council of Optometrists will be held March 24, 25, 26 and 27 at the Hotel Statler, Boston, Massachusetts. The program, under the direction of Dr. John J. O'Neil, is as follows:

SUNDAY, MARCH 24

2:00 P.M.—Opening Address—Dr. Russell W. Johnson, President, New England Council of Optometrists

2:15 P.M.—Vision in Industry—Dr. Joseph Tiffin, Div. of Education and Applied Psychology, Purdue University

7:00 P.M.—Buffet Supper and Entertainment

MONDAY, MARCH 25

10:00 A.M.—Vision Training, Part I—Dr. Carl F. Shepard, Northern Illinois College of Optometry, Chicago, Ill.

12:00 to 2:00—Exhibits—Georgian Room

2:00 P.M.—Kodachrome Clinic-Exterior Diseases of the Eye—Brendan D. Leahey, M.D., Member of the Staff, Massachusetts Eye and Ear Infirmary

3:30 P. M.—Headaches—Dr. Harold Simmerman, Pennsylvania State College of Optometry

TUESDAY, MARCH 26

10:00 A.M.—Vision Training, Part II—Dr. Carl F. Shepard

11:30 A.M.—Annual Meeting New England Council of Optometrists

12:00 to 2:00—Exhibits—Georgian Room

2:00 P.M.—Entoptic Plotting of the Macular Area—Walter R. Miles, M.D., Yale University School of Medicine

3:30 P.M.—The Correlation of Optometric Binocular Measurements for Refractive Diagnosis—Dr. Julius F. Neumueller, Pennsylvania State College of Optometry

7:00 P.M.—Annual Banquet—Entertainment and Dance

WEDNESDAY, MARCH 27

10:00 A.M.—Vision Training—Dr. Carl F. Shepard

12:00 to 2:00—Exhibits—Georgian Room

2:00 P.M.—Latest Developments in Fitting of Feincone Contact Lenses—Dr. William Feinbloom, New York

---

OPTOMETRIC REFRESHER COURSE AT UNIVERSITY OF CALIFORNIA

University of California Extension is sponsoring a series of courses for optometrists returning from military service and, as space permits, for other licensed optometrists. The program is offered by University Extension in co-operation with the University of California School of Optometry, and is sponsored by the California Association of Optometrists. The first group of classes began the week of February 18, 1946, and will extend over a six-week period. Class sessions are held at University Extension headquarters, Hill Street Building, 813 South Hill Street.

The University Extension course is designed as a condensed refresher course to refamiliarize the student with instruments and techniques, to refresh his ability to prescribe from his findings and to bring him up to date on recent developments. Dr. Charles A. Pons, president of the California State Association of Optometrists, and Dr. Gordon R. Scribner, chairman of the Association's Committee on assistance to licensees, have assisted in arranging for the courses.

A course in "Clinical Practice and Instrumentation," 801ABCD, will be instructed by Leslie W. Scown, O.D., and Joseph Ziff, O.D., while guest lecturers will include Edward Goodlaw, Bernard Hansen, Louis Jacques, Kenneth Lady, Edmund Richardson, and Harry C. Shepherd. This course covers complete physical eye examinations followed by conference and discussion of findings, prescription and dispensing of lenses, emphasis on instrumentation varied to suit needs of students, theory and use of modern ophthalmic office equipment by guest lecturers. The class will meet daily, Monday through Friday, from 7 to 9 p. m.

"Industrial Vision and Vision Tests," 802AB, will be instructed by E. A. Fletcher, M.A., Examiner in Charge of Research, California

State Division of Drivers Licenses. This is a course on the science of seeing as it is related to the efficient and safe operation of motor vehicles and other industrial occupations. Class discussions, problem assignments and laboratory work will include driver vision tests, instrumentation and measuring techniques, diagnostic and remedial interpretation of data, recording of data. The evaluation of the visual efficiency of commercial and private operators, with particular attention directed to sub-standard cases, as well as related topics, such as motor vehicle and industrial legislation pertinent to vision, will be included. This class will meet Tuesdays and Thursdays from 3 to 5:30 p. m.

A course in "Optometric Economics and Law," 855AB, meeting Mondays and Wednesdays from 2:30 to 5 p. m., will be instructed by Ralph Barstow. It is designed to present the fundamental economics and business organization essential to a sound professional practice. It will include history and development of professional optometry; California optometry law; types of practice; starting a practice, including selection of location; types of office layout, announcements and fees; financing, credits and collections; accounting procedures and simplified record keeping; public and professional relations; buying practices; insurance; and professional ethics.

Financial benefits under the G. I. Bill of Rights are extended to those eligible, and anyone desiring more complete information should communicate directly with University of California Extension, 813 South Hill Street, Los Angeles, California, immediately.

SPECIAL REPORT

INDIANA CHAPTER—AMERICAN ACADEMY OF OPTOMETRY*

CONSTITUTION

ARTICLE I. NAME

The name of this organization shall be "The American Academy of Optomery—Indiana Chapter."

ARTICE II. OBJECT

The object of this organization shall be to further the development of visual science in its efforts to conserve human vision by:

*Approved October 29, 1945.

(1) Granting unqualified and unstinted support to the several objectives of the parent organization, The American Academy of Optometry, as these are expressed in the constitution of that body.

(2) Assuming the responsibility of leadership within the state of Indiana in the field of professional optometry, in the promotion and maintenance of the highest ethical principles, in the advocation of increased standards of education, and in unselfish service to the public.

(3) Supporting, as a body and through its individual membership, the Indiana Association of Optometrists in all endeavors for the welfare of the profession, in the maintenance of its membership, and by wholehearted participation and unstinted service in its ranks.

(4) Aiding and abetting, by whatever co-operative effort required, any groups, organizations, professions and institutions concerned with the increased visual welfare of humanity.

That these principles may be accomplished in fact, the Indiana Chapter has formulated and is guided by a rigid and strict code of ethics and of professional qualifications.

ARTICLE III. OFFICERS

The officers of the Indiana Chapter shall be: a president; a vice-president; a secretary-treasurer; and an executive council which shall consist of the officers, the immediate ex-president and two other members; all to be elected at the annual meeting of the Chapter, and to serve until the next annual meeting or until their successors have been elected.

ARTICLE IV. MEMBERSHIP

Membership in the Indiana Chapter shall be restricted to optometrists and scientists of recognized professional ability and ethical standing who shall be elected to membership as provided in the By-Laws.

ARTICLE V. VOTING AND AMENDMENTS

Section 1. All amendments to this constitution and to the following By-Laws may be made by the following procedure:

(1) A written copy of the proposed amendment must be submitted to the secretary not less than sixty days prior to the scheduled annual meeting of the Chapter.

(2) The Executive Council shall vote upon this amendment and if favorably inclined, shall submit a written copy of the amendment to each member of the Chapter not less than thirty days prior to the annual meeting.

Section 2. An affirmative vote of not less than two-thirds of sixty percent of the entire membership is required for the enaction of an amendment.

Section 3. If less than sixty percent of the membership are in attendance, a vote shall be taken by mail.

Section 4. Failure to vote on an amendment within two weeks after its receipt, shall transfer the vote to the executive council.

Section 5. Where the executive council rejects a proposed amendment, notification of its rejection must be given the sponsor by the secretary, not less than thirty days prior to the annual meeting. If the sponsor can secure the signature of two-fifths of the members in support of the proposal, the proposal shall be re-submitted to the secretary and issued in individual copies for study by the entire membership not less than ten days prior to the annual meeting. The decision of the executive council shall be considered over-ruled and voting shall take place upon the amendment as is provided above.

BY-LAWS

ARTICLE I. DUTIES OF OFFICERS

Section 1. The President shall preside at all meetings of the Chapter, and shall be Chairman of the executive council. He shall appoint all committees subject to the approval of the executive council. He shall perform the duties usually devolving on the office and such others as may be directed by the Chapter.

Section 2. The Vice-President shall assume the duties of the president in his absence or at his request. He shall also share the responsibility of the treasurer in the disbursement of funds by countersigning all orders, notes, or checks for withdrawal of funds.

Section 3. The secretary-treasurer shall keep a record of all proceedings of the Chapter and of the executive council, conduct correspondence, collect dues, notify members of the dates of meetings a reasonable time in advance and perform such other duties as pertain to his office or as may be prescribed in the By-Laws.

He shall also keep all money of the Chapter, and disburse same upon joint signature of the vice-president; keep a correct account of all transactions and report them at each meeting, or when required by the president, and make a full and detailed report of the financial affairs of the Chapter, and shall at the expiration of his term of office, deliver tc his successor, all funds, papers, and books relative thereto.

Section 4. The executive council shall transact all business of the Chapter between annual meetings and shall assume such other duties as may be delegated to it by the Chapter. It shall audit the books of the secretary-treasurer. On all matters coming before it for action or decision, a majority vote of the council shall prevail. It shall have full authority to act for the Chapter in any crisis or emergency.

The executive council shall also serve as a planning and policy screening board to formulate policies and suggest plans; and to plan a specific course of procedure for the execution of those policies of service which are embodied in the President's annual address.

Section 5. Those members of the executive council not holding other office shall form a committee on admissions for the Indiana Chapter, and shall pass upon the technical proficiency of new applicants. This committee shall be empowered to conduct examinations, or to utilize any methods deemed necessary in the consideration of an applicant's ability.

ARTICLE II. ACADEMY FELLOWSHIP

Section 1. Membership is open to any practicing optometrist who meets the following requirements or to educators, scientists, and non-practicing optometrists who have conspicuously accredited themselves in the service of conserving vision.

Section 2. All practicing optometrists must be members in good standing of the Indiana Optometric Association.

Section 3. Membership in the Indiana Chapter can only be granted where the candidate is also acceptable as a Fellow of the American Academy of Optometry, and is accepted to such fellowship either prior to or simultaneously with acceptance to the Indiana Chapter. An application for membership to the Indiana Chapter is, therefore, a simultaneous application to the parent body. A single form is used for both. A candidate accepted directly into the American Academy is automatically a member of the Indiana Chapter.

ARTICLE III. PROCEDURE OF ELECTION TO FELLOWSHIP

A candidate for membership may make application in one of the two following manners.

Section 1. Application to the Chapter.

(1) The candidate may submit the standard application form and the $5.00 examination fee to the secretary of the Chapter.

(2) The secretary will refer the application to the committee on

admissions who shall determine the candidate's technical proficiency by any means required. A written report shall be made to the balance of the executive committee. If favorable, a member will be delegated to investigate the environment and characteristics of the candidate's place of practice; and to file a written report, in duplicate, with the Chapter secretary.

(3) A written report shall be made to the executive council. The secretary shall then request the entire membership of the Chapter to vote upon acceptance of the candidate. An unanimous vote is required for acceptance.

(4) If such a vote is recorded, the candidate's name shall be then submitted to the executive council of the American Academy, along with a duplicate of the inspection report filed with the Chapter secretary. Upon confirmation of acceptance by the executive council of the American Academy, the secretary of the Indiana Chapter shall then notify the applicant of his admission to both the Academy and the Chapter.

(5) If the Chapter does not record an unanimous vote in favor of admission, the candidate may gain admission by meeting the second method of entrance.

(6) If the American Academy does not confirm the favorable unanimous vote of the Chapter, the candidate may not be admitted to the Chapter.

Section 2. Application directly to the Academy.

(1) A candidate who has failed to achieve an unanimous vote in his favor, or who prefers to apply directly to the American Academy, may apply directly to the American Academy by fulfilling the procedures listed in the By-Laws of the American Academy. If he is favorably accepted by that body, he will automatically become a member of the Indiana Chapter without the necessity of the Chapter acting upon his admission.

ARTICLE IV. SPECIFIC REGULATIONS CONCERNING MEMBERSHIP

Section 1. Candidates for fellowship and members are automatically pledged and required to meet the standards of practice which apply universally to all professions, and are judged by comparison to the manner in which these standards are exercised in the environment of the practitioner by *all* professional men located in that vicinity.

Section 2. To avoid embarrassment to any prospective candidate, and to serve as a guide, the following general details are noted as minimum requirements:

(1) Location. An upstairs location is preferred in all instances and is mandatory for locations in the business districts of large cities. Location in a residence is acceptable for this detail. A downstairs location is only acceptable in smaller communities or in outlying sections of larger ones, and then only if such a location is a common practice among members of the other professions practicing in that same town or district.

(2) External Appearance. The appearance of the exterior must be of the same characteristics as those of the offices of similarly located physicians, dentists, etc. A storefront shielded by drapes or blinds is not considered equivalent to a cottage type or clinic type downstairs building.

(2) External Signs. Window and door signs must be in conformity with the regulations of the building and the practices of other professions located therein. Overhanging signs, overhead signs or illuminated signs are not acceptable other than shingles protruding from the wall which are in conformity with those used generally. Lettering of excessive size, etc., is not acceptable. In downstairs offices, window display type of lettering over large windows is not desirable unless common practice in the community. Display windows of any type which are not totally screened from the public are not acceptable.

(4) Internal Appearance. The reception room should be totally separate from the operating rooms. No display posters or manufacturer's displays are acceptable. The laboratory and fitting table should not be visible from the reception room.

(5) Stationery. All letterheads, envelopes, statements, etc., must be dignified, simple and free of advertising or claims. Cards must carry no advertising matter.

(6) Advertising. Beyond standard reminder letters, no forms of advertising are permitted, with the exception that a professional card may be published in the local paper, *if* such is the custom in the community among professional practitioners. Such notices must compare favorably with those published in the same paper. Classified telephone book advertising beyond listing in *ordinary type* is not acceptable. Educational or Informational programs in either newspapers or over the radio are acceptable only on behalf of a group or association and only when advanced for the benefit of the profession and not any single individual or individuals.

(7) Subsidiary Practices. No member may engage in any form of practice accessory to that of Optometry such as the sale of earphones or hearing devices, of optical accessories, etc.; nor may any member prac-

tice any other profession save the ophthalmologic branch of medicine and surgery, provided the practitioner is also licensed in the state of Indiana to practice Medicine, Surgery and Obstetrics.

ARTICLE V. DUES AND ASSESSMENTS

Section 1. An examination fee of five dollars ($5.00) must accompany each application which fee shall be retained by the Indiana Chapter. When the application shall have been approved by the executive council of the American Academy of Optometry the (A.A.O.) secretary shall collect the certificate fee of five dollars ($5.00) and the annual dues of fifteen dollars ($15.00). Said secretary may also collect the Indiana Chapter dues of three dollars ($3.00) which shall be returned to the Chapter secretary along with the two dollars ($2.00) allocated to the Chapter out of the national dues paid by a Fellow in Indiana.

Section 2. The annual dues of a non-practicing member shall be $8.00 per year of which $3.00 shall be retained by the Chapter and $5.00 submitted to the parent body.

Section 3. Any Fellow of the Academy whose dues and assessments remain unpaid on April 1, shall stand suspended. In event payment has not been made by July 1, his Fellowship in the Academy may cease, and he shall be so notified by the secretary. He may be reinstated by action of the executive council of the national body and upon payment of all amounts due at the time fellowship was forfeited.

ARTICLE VI. ACADEMY MEETINGS

Section 1. The Chapter shall meet at least twice each year, at a time and place set by the executive council. A complete report of each meeting shall be sent to the secretary of the American Academy.

Section 2. The executive council may meet independently when called to do so by the president or by four of the seven executive council members.

ARTICLE VII. DUTY TO THE ACADEMY

Section 1. The Chapter will make an earnest effort to induce all eligible and desirable optometrists to make application for membership.

Section 2. Any Fellow of the Academy who knows of another's failure to maintain the standards required by the constitution shall be obliged to make a written report of his knowledge, and shall send such a report to both the secretary of the Chapter and the secretary of the

American Academy. The secretary of the Chapter shall see that this report is investigated and shall notify the secretary of the American Academy of the findings.

Should the accused admit the justice of the complaint and correct the fault, no official action shall be taken.

Should the accused question the justice of the complaint, or should he fail to rectify it after admitting it, the secretary of the Chapter shall notify the executive council of the Chapter. The executive council shall then file a formal report to the secretary of the American Academy, who shall collect such further evidence as he desires and submit it to the executive council of the American Academy. It shall be the responsibility of the American Academy to take such final action as it deems necessary, and the action of the executive council of the American Academy shall be binding upon the Chapter.

ABSTRACTS

A department in which will appear abstracts of the literature of optometry, ophthalmology and applied optics. These will be classified according to the following list although contributions to all sections will not necessarily appear in each issue.

1. Ocular Refraction.
2. Physiological Optics and Color Vision.
3. Ocular Muscles.
4. Orthoptics and Reading.
5. Anatomy, Histology and Embryology.
6. Ocular and General Pathology.
7. Ophthalmic Lenses and Material.
8. Instruments.
9. Hygiene and Illumination.
10. Applied and Physical Optics.
11. Education, Sociology and Economics.
12. Miscellaneous.

1. OCULAR REFRACTION

CONTACT LENSES AND OPTOMETRY. A. Hoare. Optical World. 1945., 33., 10., 20.

Hoare believes that there is a tendency in optometry to minimize the difficulties normally encountered in properly fitting contact lenses. The intricate techniques required in this work may not be mastered in a few simple lessons.

A. V. H.

---

11. EDUCATION, SOCIOLOGY AND ECONOMICS

CONSERVATION OF VISION PROGRAM IN THE SCHOOLS OF NEW YORK STATE. E. A. Pratt, Importance of Visual Care. Published by the New York State Optometric Association, 1944, pages 44-50.

The author reviews the program for visual care now carried on in New York State, outside of the three larger cities all of which have their own programs of eye conservation. During the school year 1942-1943 the visual acuity of 571,322 students was recorded. Of this number 8.8 per cent were wearing ocular corrections and 8.3 per cent of the total were found to have a visual acuity of 20/40 or less. Those with visual defects are advised to have these corrected by an examiner of their choice. A. V. H.

ECONOMICS OF THE INDUSTRIAL PROGRAM. J. R. Witteking, Optical Journal and Review of Optometry, 1945, 82, 22, pages 23-24.

The job of the industrial optometrist is to protect and correct the visual problems of employees. As far as costs are concerned, the problem is two fold. Protection glasses are of little value without the professional services to make and keep these wearable. This is particularly true in corrected protection glasses. The author discusses the subject and stresses the fact that it is the duty of the industrial optometrist to clearly present the entire story to management who then must pay for both professional services as well as materials. C. C. K.

NATIONAL INCOME SURVEY. Public Health Bureau of the American Optometric Association, Journal of the American Optometric Association, 1945, 17, 4, pages 104-113.

A sampling was made of 2,509 optometrists to determine the average earnings of these men during the first ten years of practice. The net income after taxes was found to average as follows: After one year, $1,792. After three years, $2,691. After five years, $3,450, and after ten years, $4,587. The earning figures beyond this, were not given. The data included optometrists in practice as well as assistants and also covered optometrists in rural and urban centers of all sizes. In this latter category the findings indicated that optometrists who were practicing in urban centers of moderate size enjoyed the best average income during the early years of practice. C. C. K.

---

12. MISCELLANEOUS

VISUAL HEALTH IN A MODERN WORLD. C. Marsteller. Pennsylvania Optometrist. 1944, 4, 5. 1-3.

Optometry is the profession which corrects refractive errors of vision and muscular malfunctioning of the eyes without the aid of drugs

or surgery. The optometrist is a trained specialist who recognizes that the eye itself is only an instrument of vision, that sight is actually a brain process dependent for its correct functioning on an equally normal reaction of the nervous system. Therefore, modern optometry exhaustively schools its students not only to recognize and treat the physical defects of the eye itself, but also to study the reflex activity of the central nervous system as it governs eyesight, and to correct its deficiencies. The student is also given exhaustive training in pathology, that is, in recognizing those conditions requiring medical attention, in order that he may better serve the patient by referring him to the proper medical authority.

No profession has been more prompt in applying modern concepts of physiology and psychology to its work than has optometry. By this modern over-all concept of vision the optometrist treats the real cause of that nerve fatigue which is so often improperly referred to as "eye strain," and which is the cause of most visual discomfort and inefficiency. To function efficiently in our modern civilization, we must have comfortable as well as clear vision at all distances. We must develop special skills requiring increased mental reception and comprehension in order to perform the tasks which ordinary life now imposes. Moreover, as has been clearly demonstrated by the war and the development of aviation, we will in the future be forced to accomplish visual tasks which nature never planned for us. Optometry has developed methods to achieve these results.

T. O. B.

OBLIGATIONS OF A PROFESSION. COMMISSIONERS OF INLAND REVENUE V. RALPH CARR. Legal Supplement. The Dioptric News and Joint Council of Qualified Opticians Journal (London). 1944, August 10. No. 355.

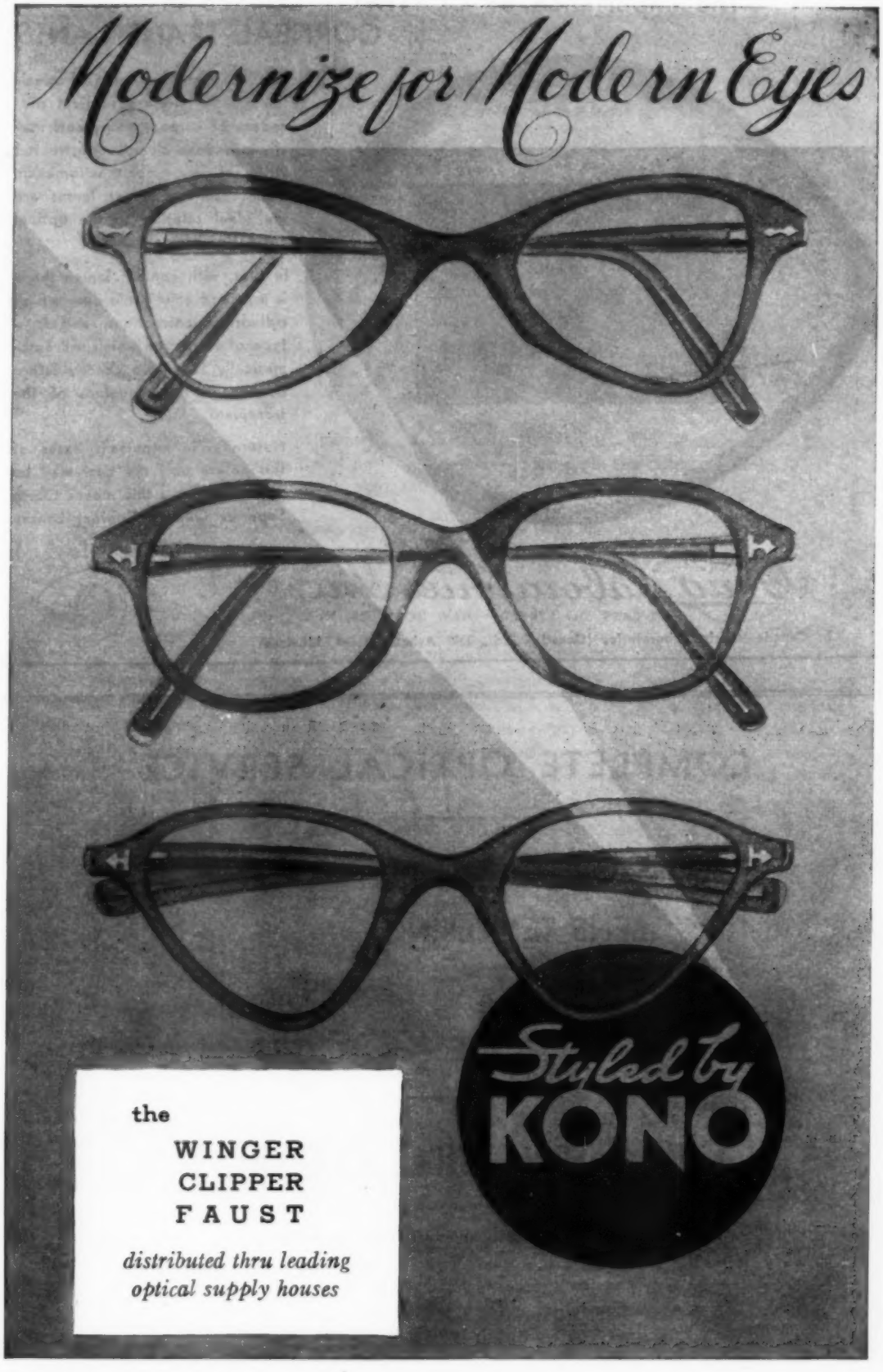
The question before the British court was whether the optometrist in this action was carrying on a professional activity and in so doing were his profits dependent wholly or mainly on his personal qualifications. The court as represented by Lord Justices Scott, and du Parcq and Mr. Justice Uthwatt found as follows:

"On those findings of fact, it seems to me that the following six considerations point to his carrying on a profession: (1) There was no advertising, even outside the premises; (2) he had the appropriate waiting room and two consulting rooms; (3) no prices were mentioned in connection with the seven or eight types of frame, exhibited in his little windows, for the observation of patients; (4) he carried out the func-

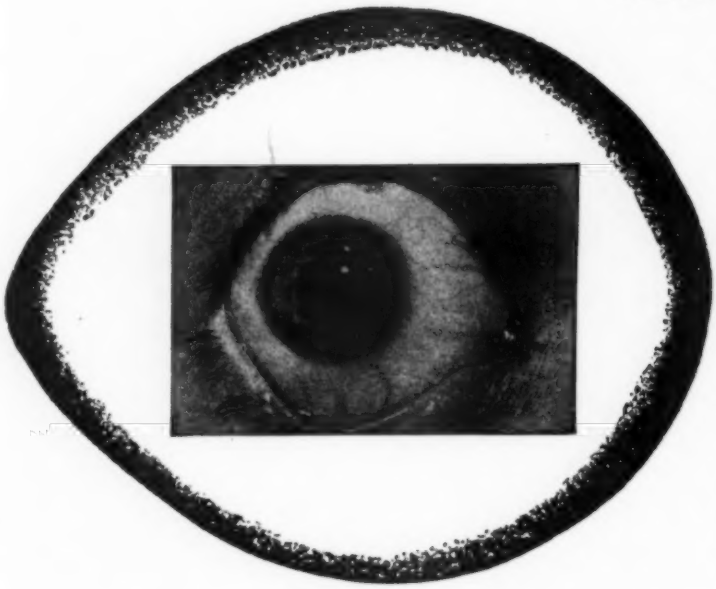
tions of examining and testing eyesight and prescribing the suitable glasses—in itself a process calling for much skill and experience—and assembling them in their frames, meaning, no doubt, that they were set in the frames, for example, at the appropriate angle, which, of course, is essential; (5) his net earnings, whatever they were called, were very substantial, particularly in relation to the expenditure on material, that is on what would be called the stock-in-trade of a business; and, finally, (6) the proportion between those earnings and the item for stock-in-trade so called in the account, was very large in relation to the stock-in-trade—far larger than it would be normally in any trading business.

"On those considerations it seems to me quite impossible to say that there was not evidence, and ample evidence, for the Commissioners to find, as they did, first, that the activity carried on by the appellant was a profession, and, secondly, that, to use the words of the subsection, the profits of the profession were dependent wholly or mainly on his personal qualifications."

T. O. B.


Modernize for Modern Eyes
Styled by
KONO
the
WINGER
CLIPPER
FAUST
distributed thru leading
optical supply houses

The Importance of CONTACT LENSES in CORNEAL TRANSPLANTS



The replacement of corneal opacities by the modern surgical procedure of corneal transplants usually produces clear, unobstructed vision. However, some astigmatism often results. Contact lenses are the ideal solution to the optical correction of such cases.

In fact, with contact lenses there is a lack of aniseikonia due to high cylindrical corrections, and is a type of correction which will automatically take care of any future change in the curvature of the transplant.

Naturally, in important cases of this nature only the best may be prescribed . . . this means Obrig Superior Quality Contact Lenses.

Obrig Laboratories Inc.

49 EAST 51st STREET • NEW YORK, 22, N. Y.

In Canada—Obrig Laboratories (Canada) Ltd., 2087 Aylmer Street, Montreal

COMPLETE OPTICAL SERVICE

LENS GRINDING

LENS TEMPERING

CONTACT LENSES

EYE PHOTOGRAPHY

N. P. BENSON OPTICAL COMPANY, Inc.

ESTABLISHED 1913

MAIN OFFICE: MINNEAPOLIS, MINN.

DULUTH · EAU CLAIRE · ABERDEEN · BRAINERD

BISMARCK · LA CROSSE · WAUSAU · RAPID CITY

STEVENS POINT · ALBERT LEA · WINONA

BELOIT · HURON · ROCHESTER

RADDE'S translation Spatial Sense & Movements of the Eye

The American Academy of Optometry takes pleasure in offering to you one of Optometry's finest contributions to science, Ewald Hering's "Der Raumsinn Und Die Bewegungen Des Auges," translated into English for the first time.

This text about which you have heard so much is now available—translated by Doctor Carl A. Radde, a member of the American Academy, eminently fitted for the task; it brings to you in Hering's own words his work on:

Retinal Correspondence	Movements of the Eye
The Horopter	The Influence of Experience
The Contest of Contours	Stereoscopy
The Law of Identical Points	Binocular Color Mixture

Accuracy of Localization in Space

No Optometrist and certainly no student can afford to be without this text which in every sense ranks with that of Helmholtz and Donders. It will hold your interest as no other text in Physiologic Optics has ever done—every page, every diagram—for it is written in a style which because of the sincere simplicity of expression will make you want to read on and on. In simple, easy and absorbing manner, it discusses the most complex of psychophysiological problems.

A SOUND BACKGROUND FOR ORTHOPTIC WORK

NOW READY—ORDER YOUR COPY TODAY—$5.00 POSTPAID

SPECIAL ORDER FORM

DR. CAREL C. KOCH, Secretary
American Academy of Optometry
Foshay Tower, Minneapolis 2, Minn.

Dear Doctor Koch:

Please send me, postage paid, one cloth bound copy of the new English translation of Ewald Hering's SPATIAL SENSES AND MOVEMENTS OF THE EYE, as written by Dr. Carl A. Radde, and published by the Academy.

I enclose Money Order or Check for $5.00 in full payment.

Dr. .....

Address .....

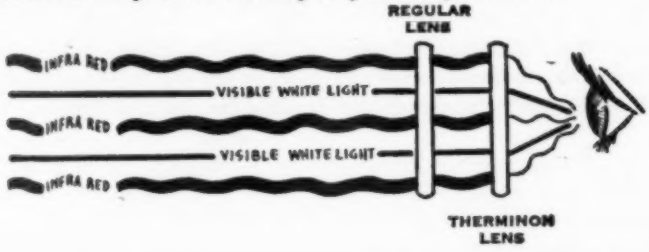
City..... State.....

Like a Filter

THERMINON LENSES SEPARATE HARMFUL FROM BENEFICIAL LIGHT RAYS

THERMINON'S exclusive properties give eyes a MAXIMUM of visual light with a MINIMUM of infra-red or heat rays. The cool green tint in THERMINON lenses brings a new meaning to genuine eye comfort.

"Give your patients this new comfort in glasses . . . their eyes will appreciate it."



THERMINON LENS CORPORATION

MANUFACTURERS OF THERMINON . . . AND OTHER FINE OPHTHALMIC LENSES

411 ELEVENTH ST. DES MOINES 9, IOWA

A Delight to the Eyes

Cushion-Mount

RIMWAY FUL-VUES
Cushioned Against Breakage

JEFFERY OPTICAL CO.

Physicians & Surgeyns Bldg.
MINNEAPOLIS, MINN.

A NEW DIAGNOSTIC METHOD OF TESTING THE COLOR SENSE

The FIRST diagnostic set of PSEUDO-ISOCHROMATIC CHARTS developed by an AMERICAN

The DVORINE COLOR PERCEPTION TESTING and TRAINING CHARTS include the following desirable features:

1. **Charts include all major colors of the visible spectrum.**
   (This test discloses difficulties in discrimination of all possible color combinations, including red and green.)
2. **The test is accurate and dependable.**
   (Accuracy of colors was controlled during the printing by constant check with group of patients.)
3. **Each chart is limited to TWO contrasting colors only.**
   (Prevents erroneous diagnosis resulting from confusion of multitude of hues.)
4. **Provides for testing patient's color nomenclature.**
   (Important procedure in any color test, yet absent in the foreign sets.)
5. **Charts are included which are visible to individuals with weak color sense.**
   (Confuses the malinger.)
6. **Test can be completed in 5 minutes or less.**
   (Results can be recorded in specific color difficulties, such as: red-green, red-brown, blue-violet, etc.)

Partial List of Purchasers of These Charts

UNIVERSITIES

Johns Hopkins University
University of Kansas
Washington University
University of Nebraska
L.S.U. School of Medicine
University of California
University of Chicago
University of Texas
University of Minnesota
University of Missouri
Indiana University
University of Arizona
etc.

COLLEGES AND SCHOOLS

Kansas State Teachers College
Occidental College, California
Board of Education, Columbiana, Co. Ohio
Oregon City Public Schools
Brooklyn College
State Teachers College, Albany, N. Y.
Austin Peay State College, Tenn.
State Teachers College, California, Pa.
Huntington College, Alabama
Carleton College, Minn.
St. Dept. of Education, Charleston, W. Va.
State Teachers College, Slippery Rock, Pa.
etc.

WHAT OTHERS SAY:

"This unique accomplishment eliminates much of the confusion and inconsistency of color vision testing, and places color sense training on a scientific basis."
—Drs. Ryer and Hotaling, New York, N. Y.

"The new set of color perception testing and training charts belongs in every orthoptic treatment room in America today."
—Dr. Carel C. Koch, Minneapolis, Minn.

MAIL THIS COUPON

ISRAEL DVORINE, O.D.,
2328 Eutaw Place,
Baltimore 17, Md.

Send me the two volumes of
"DVORINE COLOR PERCEPTION TESTING AND TRAINING CHARTS" $25.00
(including booklet of instructions)

Name .....

Address .....

City and State .....
(Postage prepaid if check accompanies order)

FEINCONE CONTACT LENSES

TANGENT CONE SERIES **FITTED BY OPTOMETRIC TECHNIQUE**

NO MOLDING • NO ANAESTHETIC

SCHEDULED INSTRUCTION COURSES IN FITTING TECHNIQUE

	Original Schedule—Registrations Closed	Additional Schedule
Chicago	March 3rd, 4th, 5th	March 6th, 7th, 8th
Omaha	March 10th, 11th, 12th	* * * *
St. Louis	March 17th, 18th, 19th	* * * *
Cincinnati	March 24th, 25th, 26th	March 27th, 28th, 29th
New York	March 24th, 25th, 26th	March 27th, 28th, 29th
Boston	April 7th, 8th, 9th	April 10th, 11th, 12th

The original instruction schedule in the left hand column above was recently announced and immediately filled. In order to take care of the over-registration, the additional schedule in the right hand column above has been established. There was also an excess registration at Omaha and St. Louis, but an instructor is not now available to give these additional courses.

Future instruction courses will be announced in these pages as they are scheduled. Both theory and clinical practice are covered in the course, the fee for which is $75.00.

FURTHER INFORMATION ON REQUEST

FEINBLOOM CONTACT LENSES, INC.

20 NORFOLK STREET **NEW YORK 2, N. Y.**

Mayfair FUL-VUE

The new Zyl frame with optically correct lens areas and a bridge that really fits—combined with the popular upsweep.

Looks well on men, too.

MINNESOTA OPTICAL COMPANY

621 West Lake St. Minneapolis

EDITORIAL NOTICE TO CONTRIBUTORS

The American Journal of Optometry and Archives of American Academy of Optometry is a monthly journal, published in annual volumes of about six hundred pages of reading matter each, illustrated where necessary, by cuts in the text.

About one-half of the space is devoted to technical articles, and the remaining half is given over to special departments, editorials, abstracts and book reviews, in large part original.

The papers and reports are original and are accepted only with the understanding that they are to be published in this journal exclusively.

The editors of the American Journal of Optometry and Archives of American Academy of Optometry beg to offer the following suggestions to authors who propose to favor them with the publication of their contributions:

I. Write on one side of the paper. Double-spaced, typewritten MS. is preferred.

II. Words to be printed in *italics* should be underscored once, in SMALL CAPS twice, and in LARGE CAPITALS three times. **Antique type** when called for should be so marked.

III. Be sure that the title of your paper indicates its contents. Should the subject be a general one, for instance, Case Reports, it would be well to mention the subject of each special report—for instance: Case One. Progressive Myopia with Exophoria. Case 2. Divergent Squint with Amblyopia. These special titles will appear in the table of contents of each number.

IV. Illustrations should be carefully drawn with India Ink on separate sheets.

V. When authors receive proofs for revision, they should correct and return these without delay. We beg, however, to remind our contributors that changes in the manuscript necessitates resetting, this causing much additional expense, so we ask that alterations be limited to what is of essential importance.

VI. Because of the added cost, we have discontinued the giving of gratuitous reprints to our authors, but we will supply them with these at the cost of press work and paper where so desired. The following tables of charges will apply for the year 1946.

Number of	Number of Pages in Reprint					
Reprints	4	8	12	16	20	24
100	$6.90	$12.40	$15.50	$18.40	$21.85	$24.70
250	11.30	20.10	25.95	28.15	30.70	36.40
500	18.10	30.50	37.50	41.70	46.25	55.45

Prices for greater numbers furnished on request. Orders for reprints should be placed at the head of the manuscript, or should at the latest reach us before the Journal has gone to press.

When sending manuscripts to the American Journal of Optometry and Archives of American Academy of Optometry, please address the editor: Dr. Carel C. Koch, 1501-1504 Foshay Tower, Minneapolis,

VISUAL CORRECTION
PLUS
EYE PROTECTION

Physical Protection FOR THE EYE
is also Essential

Vision worth correcting comes through eyes worth protecting. Serious eye injuries and loss of sight, as well as painful lacerations, are continually resulting from lenses being accidentally broken while worn. Motex Safety Construction, added to an ophthalmic correction, eliminates these hazards. It does not limit choice of lens but can be added to practically any kind of single vision or bifocal correction.

OPTICAL INDUSTRIES, INCORPORATED
INDIANAPOLIS, INDIANA
Manufacturers of Ophthalmic Lenses for the Profession
Pioneers in the Successful Production of Safety R Lenses

HERING'S -- SPATIAL SENSE & MOVEMENTS OF THE EYE

Only English translation by
Carl A. Radde, O.D., F.A.A.O.

An authoritative book giving the basic facts relating to ocular movements and binocular vision.

Cloth Bound $5.00
Pre-paid

Published by the
American Academy of Optometry
Foshay Tower Minneapolis 2, Minn.

Contact Lenses

YOUR PRESCRIPTION and technical fitting details precisely interpreted in fine plastic by our SKILLED TECHNICIANS. No prescription too complicated for precision grinding in our laboratory. Feel free to consult with us on any of your contact lens problems. Complete line of fitting equipment also available from us. Inquire about our instruction manual and our complete course on technique of fitting contact lenses.

PRECISION CONTACTS

BRANCH LABORATORY:
817-820 Park Central Building
Los Angeles 14, California

MAIN OFFICE AND LABORATORY:
Sterling Building, 914 Marquette Ave.
Minneapolis 2, Minnesota

To Subscribers in the Armed Services:---

Subscribers in the armed forces may not know that when they are discharged from the service that they are entitled to as many remaining copies of this publication as were paid for under the military rate, in spite of the higher subscription price for optometrists in private practice.

When you are discharged or transferred to another theatre please advise us promptly. Give us the address where you last received the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY and your new address, either military or civil. Only by so doing can you hope to receive the full number of copies to which you are entitled. Subscriptions are still accepted from optometrists in the armed services at the special military rate of $2 per year.